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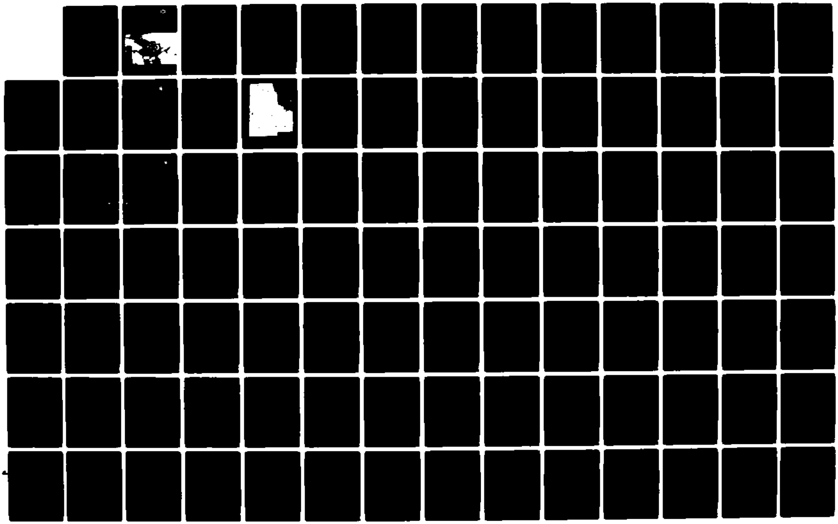
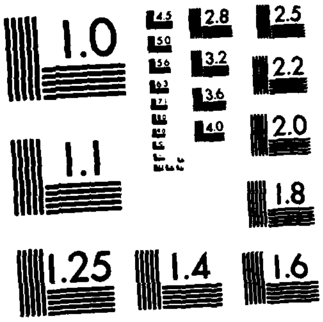




Special Report 82-21

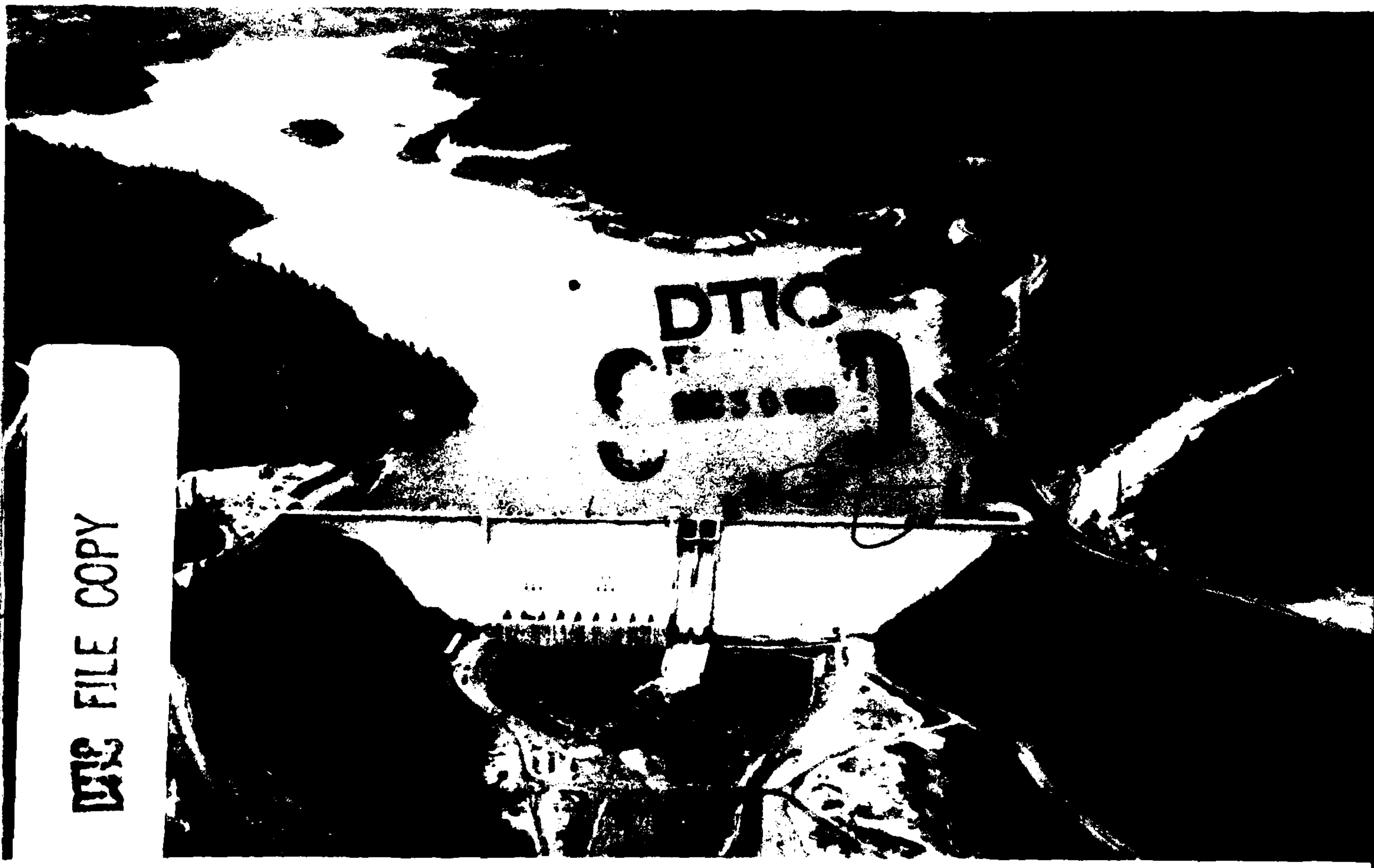
October 1982

US Army Corps of Engineers
Cold Regions Research & Engineering Laboratory

Limnological investigations: Lake Koocanusa, Montana

Part 1: Pre-impoundment Study, 1967 – 1972

Thomas J.H. Bonde and Ronald M. Bush



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FOREWORD

The Kootenai River basin, Libby Dam and the resulting Lake Koocanusa, have been of interest to CRREL investigators since the mid-1970's. We have focused on a number of cold regions remote sensing, water quality, and limnological problems. Of particular interest are those associated with winter ice cover, spring snowmelt runoff, and low temperature chemical reactions in sediments and in the water column. Since CRREL and the Seattle District have conducted a number of short and long term studies on the Kootenai River and Lake Koocanusa, we considered it appropriate to make the results of those investigations readily available in a series of reports. Therefore, we are issuing these results in the CRREL Special Report series under the overall title *Limnological investigations: Lake Koocanusa, Montana.*

Part 1: Pre-impoundment study: 1967–1972, with appendix, *Basic data*
(CRREL Special Report 82-21)

Part 2: Environmental analyses in the Kootenai River region, Montana
(Reprint of CRREL Special Report 76-13)

Part 3: Basic data, post-impoundment: 1972–1978

Part 4: Factors controlling primary productivity
(CRREL Special Report 82-15)

Part 5: Phosphorus chemistry of sediments
(CRREL Special Report 81-15)

Cover: Libby Dam and Lake Koocanusa, Montana, 1975. (Photograph by U.S. Army Engineer District, Seattle.)

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This report documents the effects of the construction of Libby Dam upon the water quality of the United States portion of the Kootenai River during the pre-impoundment phase of a long-term water quality study. Water quality problems during dam construction appeared to be restricted to short-term increases in suspended sediment and turbidity which suppressed the aquatic insect population in the river downstream. Abnormally high background concentrations and abrupt chemical changes in water quality during the course of the study were attributed to industrial discharges from a fertilizer plant and mining operation

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20. Abstract (cont'd)

located on an upstream tributary to the river. Nutrient loadings of nitrogen and phosphorus were found to be of sufficient magnitude to predict the development of eutrophic conditions following inpoundment suggesting that efforts in controlling nutrient point sources be continued.

PREFACE

This report was originally prepared in 1975 by Thomas J.H. Bonde, Libby Dam Resident Office and Ronald M. Bush, Environmental Resources Section, Seattle District, Corps of Engineers. Publication of this report is in conjunction with the Corps of Engineers Civil Works Program, Environmental Quality, Work Unit 31013, Environmental Effects and Criteria for Engineering Works in Cold Regions.

While it would be impossible to thank the many friends, colleagues, and associates who have assisted in this study and measurably contributed to its progress, the contributions of several individuals deserve special recognition. Particular appreciation is given to Phillip L. Cole, Resident Engineer, Libby Dam, for his personal interest and encouragement throughout the study and Anthony V. Munch and others in the Libby Resident Office for their assistance in the study. General R.E. McConnell, district engineer during the early phase of the study, Sidney Steinborn, Robert Sato, Robert Ayres, Norm MacDonald, and Roger Ross all deserve a special thanks for their roles in the conception and growth of the study.

The contribution of Robert Rulifson of the Environmental Protection agency, Robert Schumacher and Joe Huston of the Montana Department of Fish and Game, and Phil Torangeau of the University of Montana were deeply appreciated. Much of the credit for the quality of the data can be given to George Pike and his staff, particularly Roger Knapton, Lynn Hull and the field personnel of the Kalispell office of the U.S. Geological Survey. The aid of Inez Herrig and the staff of the Lincoln County Library, who went out of their way to obtain needed reference material, is gratefully acknowledged.

A study of the United States reach of the Kootenai River was undertaken in 1967 to document the effects on water quality from construction and operation of Libby Dam, Montana. This report presents the results of the first or preimpoundment phase of the ongoing study. In March 1972 the river was impounded and the reservoir, Lake Koocanusa, was formed. Lake Koocanusa is a relatively large reservoir with an average surface area of 1.5×10^8 m^2 (3.75×10^3 acres) and a mean depth of 43 m (113 ft). It is about 145 km (90 miles) in length at full pool, extending some 68 km (42 miles) in Canada. In the preimpoundment phase of the study, phosphorus and nitrogen loadings in the Kootenai River were found to be sufficiently high to predict the development of eutrophic conditions, particularly nuisance algal blooms, in the lake following the river impoundment. This prediction was realized when nuisance algal blooms occurred in Lake Koocanusa in the fall of 1974 and late summer and fall of 1975. The bloom species was *Aphanizomenon flos-aquae*, a blue-green algae characteristic of eutrophic waters. The blue-green algae also occurred in the lake in 1973 but not in bloom proportions.

Current measures for control of eutrophication in Lake Koocanusa and the Kootenai River appear promising. The major source of phosphorus entering the Kootenai River system has been waste discharged from a fertilizer plant located on a tributary of the Kootenay River in British Columbia. Following the issuance of wastewater effluent regulations by the Britich Columbia Pollution Control Branch, the fetilizer company is undertaking a two-phase waste treatment program. The first phase, completed 30 Septebmer 1975, recycled gypsum waste and has reportedly achieved over 80% reduction in phosphorus in the effluent. The second phase, scheduled for completion in late 1977, will result in a reduction of phosphorus in the waste effluent of 99%. Furthermore, the communities that have been discharging domestic wastes into the river system in British Columbia are upgrading their treatment systems, with some communities choosing land application methods rather than discharging their effluent to surface waters.

The postimpoundment phase of the water quality study will document the effects on the limnology and water quality of Lake Koocanusa and the Kootenai River from treatment of wastewaters discharged into the river system. The first of the postimpoundment reports is expected to be completed in early 1977.

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1.0 SUMMARY AND CONCLUSIONS

This report documents the water quality of the United States reach of the Kootenai River for the period October 1967 through March 1972. The end date marks the impoundment of the river by Libby Dam in Montana and the beginning of a postimpoundment study, to be reported upon at a future date. The study was conducted by the U.S. Army Corps of Engineers with coordination and cooperation of state and Federal agencies and Canadian agencies. Published concurrent with this report is a report by the British Columbia Pollution Control Branch to document the quality of the Kootenai River within Canada prior to river impoundment (Crozier and Leinweber, 1975).

1.1 Findings.

A significant decrease in the values for a number of water quality parameters was observed in the Kootenai River in 1968 following the implementation of waste water treatment controls to an industrial discharge to a tributary of the Kootenay River in Canada. Nevertheless, the concentration of several constituents of the river's water, particularly phosphorus, continued to be higher than would have been found naturally in the Kootenay River.

The aquatic insect population of the river increased between 1968 and 1969 and remained high throughout the study. Such suggests that the chemical changes noted in the river after implementation of the industrial effluent control in Canada had a beneficial effect upon the insect population.

The nutrient concentrations and loadings, especially phosphorus, of the river were sufficiently high to predict the development of eutrophic conditions in the lake (Lake Koocanusa) formed by impoundment of the river by Libby Dam. A reduction in phosphorus input to the river system is necessary to prevent the development of eutrophic conditions such as nuisance algal blooms in Lake Koocanusa.

Water quality problems observed from Libby Dam project construction activities appeared to have been restricted to increases in suspended sediment and turbidity. Short-term increases in suspended sediment and turbidity due to channel diversions and such activities as drainage of settling ponds created occasional problems, but the major increases occurred coincident with higher river discharge when the hydraulic force and erosive capacity of the river was at its greatest. The increase in suspended sediment from dam construction activities had adverse biological effects on the river as indicated by the suppression of the aquatic insect population up to 14.5 km (9 miles) downstream of the dam site.

1.2 Recommendations.

The waters of the Kootenai River are potentially highly productive, principally as a result of man's activities. Progress has been made in controlling the cultural addition of nutrients and deleterious materials to the Kootenai River system during the course of the preimpoundment study, and facilities to effect further control are planned. The key factor for improving the water quality of the Kootenai River system is the close coordination and cooperation with the Canadian agencies, particularly the British Columbia Pollution Control Branch, through the Water Quality Task Force. Coordination with the Canadian agencies through the task force should be continued.

In order to (1) document the effects of the anticipated waste water control programs on the quality of the river system, (2) document the downstream effects from impoundment of the river by Libby Dam, (3) determine the conditions of the Libby Dam reservoir (Lake Koocanusa), and (4) make meaningful management decisions toward maintaining or improving the quality of the resource, the water quality study of the river system should be continued. The study should continue to be fully coordinated with the state, Federal, and Canadian agencies.

Water quality problems encountered during Libby Dam Project construction activities were principally high suspended sediment and turbidities. Although the increases in suspended sediment and turbidity were generally short term, they did have an adverse effect upon the aquatic ecosystem. The major causative factor appeared to be river diversions. With their inherent water quality problems, diversions should be discouraged. Where diversions are necessary, they should be scheduled to be constructed in the "dry" and utilized on a short-term basis during the period of low flows.

The incorporation of special provisions within construction contracts requiring compliance with state and Federal water quality standards is an effective tool in preventing or minimizing water pollution. Equally important are information pamphlets and preconstruction meetings which bring to the attention of the contractors the water quality standards and the fact that the standards will be strictly enforced. A water quality monitoring program is a compelling addition to these provisions and should be incorporated into the planning, construction, and operation of every major project.

Efforts to prevent water pollution problems during the construction phase of a project can be made more effective by actively seeking the advice and assistance of pollution control and fish and wildlife agencies and notifying them when problems occur, a major activity during the construction of Libby Dam. However, there is often little that can be done at the construction site to remedy water quality problems caused by what environmentally has been poorly planned, engineered, or designed. All projects and contracts should be thoroughly reviewed from a water quality standpoint prior to construction to ensure that they can be built with maximum benefits to the present and potential users of the water resource without deterioration of its quality.

2.0 INTRODUCTION

The Kootenai River (spelled Kootenay in Canada) is a major tributary of the Columbia River and drains parts of southeastern British Columbia, northern Idaho, and northwestern Montana. The river originates in Canada, enters the United States, re-enters Canada and flows into Kootenay Lake, and eventually enters the Columbia River at Castlegar, British Columbia.

In 1966 construction was begun on Libby Dam near Libby, Montana. Libby is one of four dams being constructed under an international treaty to develop the headwaters of the Columbia River. The dam and its reservoir, now officially called Lake Koocanusa, were designed to provide power, flood control, and recreation benefits.

With the start of construction, considerable concern was expressed over the possible detrimental effects that dam construction and river impoundment could have upon water quality and the aquatic ecosystem. Recognizing the many ecological unknowns in this field and the notable lack of specific data related to the Kootenai River, the Corps of Engineers, with the assistance of a number of state and Federal agencies, implemented a water quality study program. High phosphorus concentrations found in the river during early phases of the study and recognition of the potential eutrophic conditions that could result from high phosphorus loading following impoundment led to the development of a joint water quality program between Canada and the United States.

2.1 Purpose and Scope.

The principal objectives of this study as originally formulated in 1967 are threefold:

1. To provide reliable scientific data on various water quality parameters before, during, and after the construction of Libby Dam Project.

2. To utilize these data in predicting, insofar as possible, any detrimental changes in water quality that are occurring, or may be likely to occur, as a result of the project.

3. To recommend actions that can be taken to avoid or minimize water quality problems.

The lack of water quality data on the Kootenai River and its tributaries played a large part in the decision to undertake the study and in its ultimate design. Information on the portion of the river within the United States was virtually lacking. Public health, pollution control, and fish and wildlife agencies recommended that data be collected within their particular field of interest. These requests were accommodated whenever possible. In addition, it was felt that there were valid scientific reasons for obtaining biological and limnological information on impoundment of a cold water stream. These reasons, coupled with a growing environmental awareness of the public as reflected in Congressional and Executive actions, determined the final direction of the study.

Following meetings with personnel of the British Columbia Pollution Control Branch beginning in 1969, the scope of the study was enlarged to include most of the basin lying upstream from Kootenay Lake. Additional parameters and sampling stations were located on the mainstem of the Kootenai River and its tributaries in both the United States and Canada. Efforts were made to standardize and improve sampling and analytical techniques and provide for the mutual exchange of data.

The purpose of this report is to: (1) present the results of water quality sampling on the United States' portion of the Kootenai River during construction of Libby Dam, incorporating more recent data with that contained in previous reports (U.S. Army Corps of Engineers, 1969, 1970, 1971), (2) to delineate and analyze any physical, chemical, or biological changes occurring in the river during this period, and (3) to provide recommendations for maintaining and improving water quality conditions throughout the entire basin.

2.2 History of Study.

Libby Dam and Reservoir Project was authorized by the 81st Congress of the United States in 1950. Preliminary planning began in 1952. As the project involved both upstream storage and downstream effects, not only in the United States but in Canada; the project was built under an international treaty relating to the cooperative water resource development of the Columbia River Basin. This treaty, which sanctioned construction of Libby and three Canadian dams, was ratified by the U.S. Congress in 1961 and by the Canadian Parliament in 1964. Construction work on the Libby Dam project began in 1966.

The Corps of Engineers, with the cooperation of the Federal Water Pollution Control Administration (FWPCA) (now under the Environmental Protection Agency), began preliminary planning for a water quality study in 1966. Final details of the study, through coordination with the U.S. Geological Survey, Montana Department of Health, and Montana Department of Fish and Game, were completed at a joint meeting in the spring of 1967. As a result of this meeting the Corps of Engineers agreed to a study plan in which the Corps would maintain sampling stations in the area from below the dam site upstream to the International Boundary, while the Environmental Protection Agency (EPA) would maintain those from Libby downstream to the International Boundary. Sampling began at Corps of Engineers stations in October 1967 and at EPA stations in March 1968. Contracts for the analysis of bottom fauna samples and the study of fish population were made with the University of Montana and the Montana Department of Fish and Game by the Corps of Engineers.

The Water Resources Service of the Province of British Columbia and the Corps of Engineers were the agencies designated by the Columbia

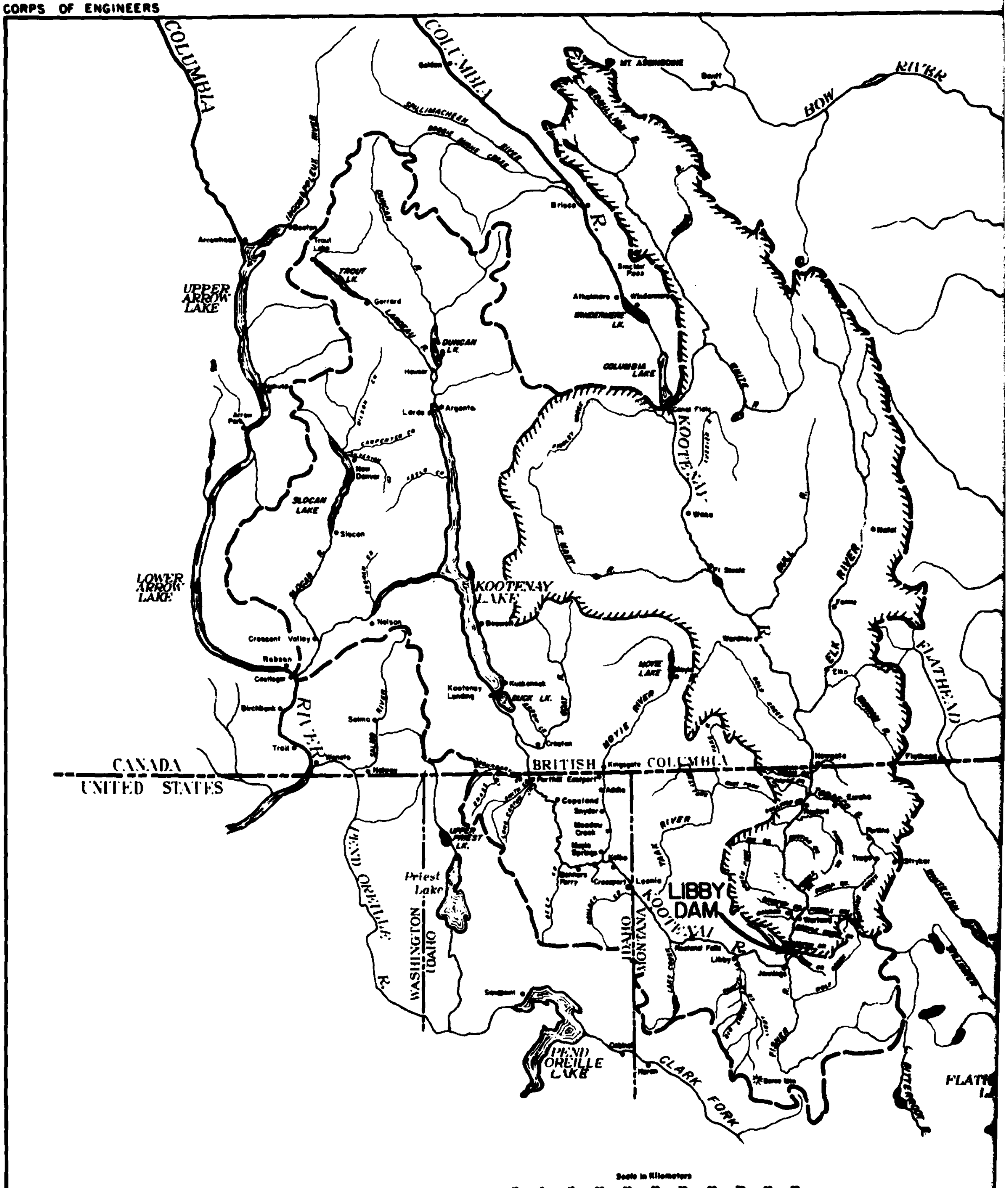
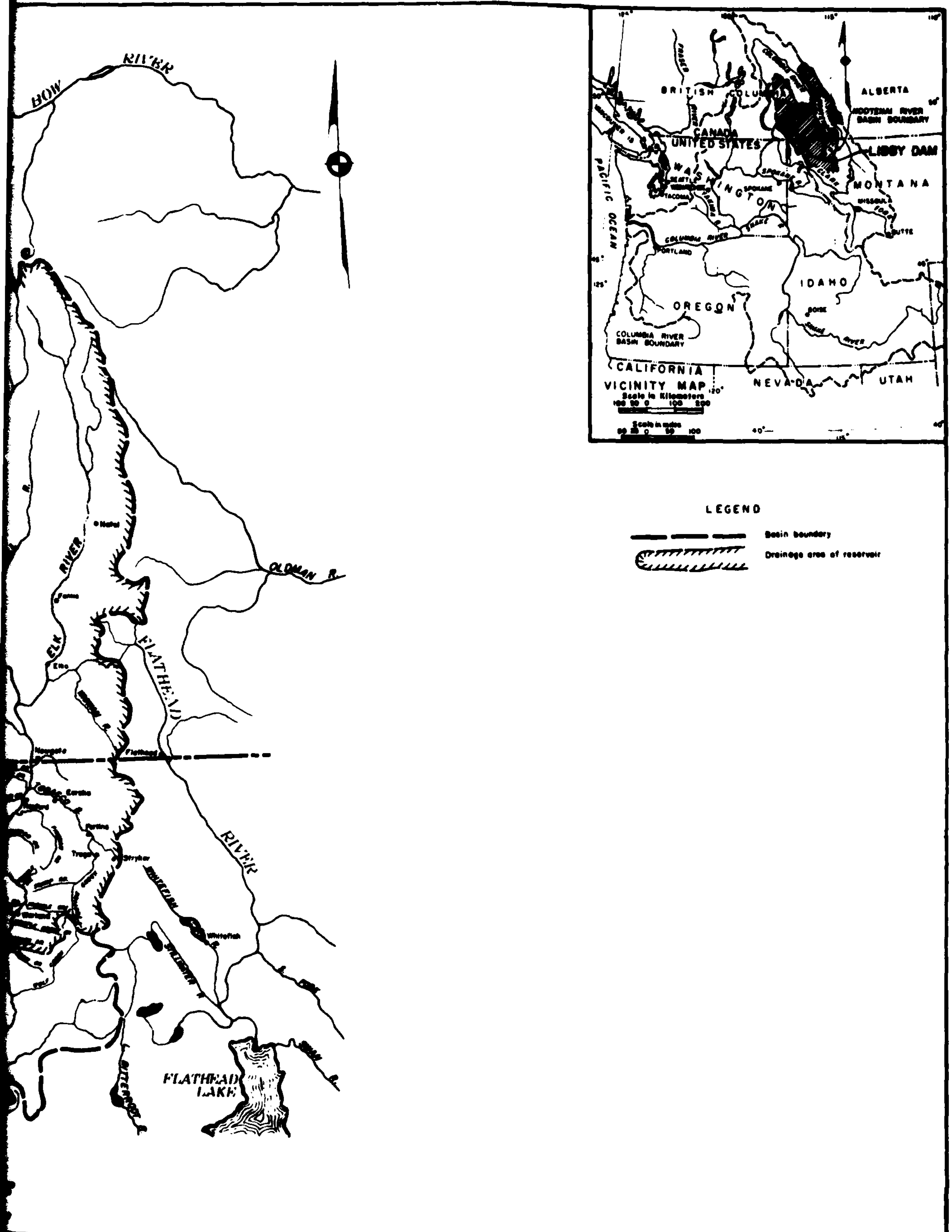


Figure 1. Kootenai River drainage basin.



BOW RIVER
OLDMAN R.
ELK RIVER
FLATHEAD RIVER
FLATHEAD LAKE
BRITISH COLUMBIA
ALBERTA
KOOTENAI RIVER BASIN BOUNDARY
CANADA
UNITED STATES
LIBBY DAM
WASHINGTON
MONTANA
PACIFIC OCEAN
OREGON
IDAHO
COLUMBIA RIVER BASIN BOUNDARY
CALIFORNIA
NEVADA
UTAH
VICINITY MAP
Scale in Kilometers
Scale in miles
LEGEND
Basin boundary
Drainage area of reservoir

River Treaty to represent Canada and the United States in activities related to the construction of Libby Dam. A task force consisting of the British Columbia Pollution Control Branch, the Corps of Engineers, and other United States' agencies was established in October 1969.

2.3 Watershed Characteristics.

2.3.1 Description of the Basin.

The Kootenai River Basin is located between 48° and 51° North latitude and 115° and 118° West longitude and includes within its boundaries parts of southeastern British Columbia, northern Idaho, and northwestern Montana. A map of the Kootenai River drainage basin is presented in figure 1.

The basin measures 383 km (238 miles) long by 246 km (153 miles) wide and has an area of 49,987 sq km (19,300 sq miles). About one-quarter of the area, or about 12,432 sq km (4,800 sq miles), lies in the United States. An Earth Resources Technology Satellite (ERTS) mosaic taken from an altitude of 917 km (570 miles) and covering all but the most western part of the basin is shown in figure 2.

The basin ranges in elevation from about 418 m (1,370 ft) above mean sea level, where the Kootenai enters the Columbia River near Castlegar, B.C., to the 3,618 m (11,870 ft) peak of Mt. Assiniboine on the Continental Divide in the northeastern part of the basin. The section of the river lying in the United States ranges from an elevation of about 704 m (2,310 ft) as it enters the country to 533 m (1,750 ft) above mean sea level as it leaves the country.

2.3.2 Geology.

The Kootenai River Basin lies in the Northern Rocky Mountain Physiographic Province. This province is characterized by successive mountain ranges trending north to northwest separated by long straight valleys lying parallel to the ranges. Major land features include the McDonald, Whitefish, and Salish Mountains on the east, the Purcell Mountains in the center, and the Cabinet and Selkirk Mountains on the south and west. Separating these ranges is the Rocky Mountain Trench on the east and the Purcell Trench on the west. Except for the relatively broad, flat valleys in these trenches where the terrain is moderate, the area is typified by narrow valleys and rugged steep slopes with frequent rock outcroppings.

The mountain ranges are composed of folded and faulted crustal blocks of metamorphosed, sedimentary rock materials of the Precambrian Belt Series. This series consists of durable siliceous argillites, quartzites, and impure limestones created during an earlier era from various mixtures of clay, silt, sand, and carbonates which were subjected to low-grade metamorphism. Minor basaltic flows are also present.

2.3.3 Hydrogeology.

The occurrence and distribution of ground water in the drainage is closely related t the geology. Rock outcrops of the Belt series are

Figure 2. ERTS photomosaic of the Kootenai River drainage basin; images acquired on 7 and 8 Feb 73; approximate location of the United States-Canada border, Libby Dam (1), Lake Koocanusa (2), Kootenai River (3), and Kootenay Lake (4).

tightly compacted with little or no porosity or permeability and in these areas ground-water production is small. Glacial deposits consisting of a well-compacted, poorly sorted mixture of clay, silt, sand, and gravels interbedded with glacial lake sediments of finely laminated silty-clay created by periodic damming of the Kootenai River are characteristic of the valleys. In certain of these areas, wells produce an abundance of water. The complex heterogenous nature of these deposits makes their water-bearing characteristics highly variable and ground-water supplies range from virtually nil to excellent.

Numerous springs and seeps occur throughout the basin. Ground water provides much of the base flow of the river and its tributaries during a large part of the year. Characteristically, this water is of excellent quality but more mineralized than water derived from surface supplies.

2.3.4 Climate.

The Kootenai River Basin at its nearest extension lies only 523 km (325 miles) from the Pacific coast and its climate is affected by both modified maritime and continental influences. Maritime influences are generally dominant in the winter and result in rain or snow when warm Pacific air masses are cooled on passing through the mountain ranges. Continental influences are generally dominant in the summer when northward extensions of low pressure areas from the hot southerly interior cause heavy convective-type showers with occasional cloud bursts. Winters are neither as wet nor as warm as the Pacific coastal areas, but are generally less severe than areas to the east of the Continental Divide. The coastal tendency for dry summers persists, but the dominant maritime influence gives way to continental influences as one moves eastward through the basin. Characteristic of most mountainous areas, weather patterns within the basin are complex, with local variations stemming from differences in elevation and specific location in relation to the various mountain ranges.

Temperature

A mean annual temperature of about 5.0°C (41°F) seems to be most representative of the basin as a whole with a fairly wide range between reporting stations. July is the warmest month with mean temperatures ranging from 19.4°C (67°F) at Libby to 13.9°C (57°F) at Sinclair Pass. The extreme maximum temperatures of record at the same stations are 42.8°C (109°F) and 36.1°C (97°F). January is the coldest month of the year with mean recorded temperatures ranging from -5.6°C (22°F) at Libby to -11.1°C (12°F) at Sinclair Pass. The extreme low temperatures at the same stations are -43.3°C (-46°F) and -42.2°C (-44°F) respectively. Extremely low temperatures are not common, however, and at Libby temperatures of -18°C (0°F) are reached on only 12 days in an average year. Oppressive heat and humidity combinations are also rare and the effects of hot summer days are moderated by strong nighttime cooling.

Growing Season

The large difference between daily high and low temperatures is most pronounced in its effect in reducing the length of the growing season. The average frost-free period at Libby, Montana, is 79 days, Newgate, B.C., 93 days, and Cranbrook, B.C., 77 days. The shortness of the growing season limits agriculture and native vegetation to only the more hardy species.

Precipitation

The mean annual precipitation for the basin is only 76 cm (30 in) with a variation within the basin of from about 36 cm (14 in) to an estimated 305 cm (120 in) at highest elevations. Approximately 70 percent of the total precipitation falls as snow. The annual snowfall varies from about 102 cm (40 in) at the lower elevations to 762 cm (300 in) in some parts of the mountain areas. Most of the snow falls during the November - March period, although heavy snowstorms can occur as early as mid-September or as late as 1 May.

Cloud Cover

Winters are characteristically cloudy with overcast conditions prevailing as much as 75 percent of the time. Throughout the balance of the year, partly cloudy or clear weather prevails. During the summer months more than 50 percent of the days are clear.

Winds

Being sheltered by the mountains, destructive winds are rare at lower elevations in the basin. The average wind speed at Cranbrook, B.C., is about 9.7 km/hr (6 mph).

2.3.5 Vegetation.

The dominant vegetal type within the basin is coniferous forest with dense stands of trees covering perhaps as much as 90 percent of the basin area. Only a small amount of the area can be classified as agricultural and this is used largely for pasture or hay production. The amount of land devoted to cultivated crops is small.

2.3.6 Cultural Development.

The portion of the Kootenai River Basin lying within the United States is sparcely inhabited. Cultural development has been restricted to the river valleys by the relatively steep mountainous terrain. Human habitation, and the few communities and industries that exist, are found along the Kootenai River and its major tributaries in Boundary County, Idaho, and Lincoln County, Montana. Population figures for these two counties provide a fairly accurate estimate of the basin population in the United States.

County	Population 1960	1970
Lincoln		
Urban	4,942	5,980
Rural	7,595	11,420
Total	12,537	17,400
Boundary		
Urban	--	2,797
Rural	5,809	3,574
Total	5,809	6,371
Total Both	18,346	23,771

The basin population has grown by 30 percent in the 10-year period, 1960 to 1970. Most of this increase has occurred in Lincoln County due in large part to the influx of construction personnel working on Libby Dam which, according to Mueller and Wirth (1970), has increased the county population by between 2,500 and 3,000 persons. While the basin population can be described as semi-rural with most people living in unincorporated communities of 2,500 people or less, the rural population is predominantly nonfarm.

The basic industries in the study area are the harvest and manufacture of timber products, mining, agriculture, and tourism. The construction industry has experienced considerable growth with the construction of Libby Dam, but this is believed to be a short-term gain which will decline following the completion of the dam. The quantity, availability, and the type of natural resources in the area would tend to indicate the economy of the area. While agriculture is not a major industry, with arable lands occupying only about 2 percent of the basin area (White, 1960), it does provide a degree of diversity to the economy. Tourism is an industry that has experienced considerable growth in this area in recent years and it is expected that its potential will be enhanced by the completion of the Libby Dam project.

2.4 Stream Characteristics.

2.4.1 Description of the River.

The Kootenai River has a length of approximately 780 km (485 miles) of which 266 km (165 miles), or about one-third of its length, is in the United States. The source of the Kootenai is located in Kootenay National Park, British Columbia, adjacent to the Continental Divide and about 48 km (30 miles) west of Banff, Alberta.

From its source it flows about 161 km (100 miles) south entering Rocky Mountain Trench near Canal Flats, only 2.4 km (1.5 miles) from Columbia Lake, the headwaters of the Columbia River. From this point the river continues southward another 161 km (100 miles) entering the United States in the vicinity of Rexford, Montana, where it leaves the Rocky Mountain Trench and continues, passing southward through the mountains of the Purcell Range for about 80 km (50 miles) to the confluence of the Fisher River. Here the river turns abruptly west, passing over Kootenai Falls in a gap between the Cabinet and Purcell Mountains. Near Troy, the river trends northwestward to Bonners Ferry where it enters the Purcell Trench. At Bonners Ferry the valley widens and the river meanders northward some 76 km (47 miles), where it reenters Canada. Shortly after crossing the border, the river flows into Kootenay Lake. From the west arm of Kootenay Lake, the river flows 37 km (23 miles) west to its junction with the Columbia River.

2.4.2 Discharge.

The mean annual discharge of the river at its mouth is 796 cu m/sec (28,100 c.f.s.) making the Kootenay the second largest tributary of the Columbia River System, exceeded in volume only by the Snake River. Tributary streams of various sizes are numerous and continuously add to the river's size throughout its length. The significance of the major tributaries in relation to the size of the river is shown in figure 3. Runoff contributed from drainages lying largely within the United States represents an average annual volume of over 5 x 10^9 cu m (4,058,000 acre-feet), or about 20 percent of the average annual runoff of the river as it joins the Columbia River. A summary of the discharge of the river and its major tributaries at selected gaging stations in the United States can be found in the appendix, table 1.

The longest historical record for the Kootenai River is from the gaging station at Libby, Montana, with records extending back to 1910. A summary hydrograph showing daily means and extremes is shown in figure 4. Daily, monthly, and annual duration curves for the Kootenai River at Libby can be found in the appendix, figure 1.

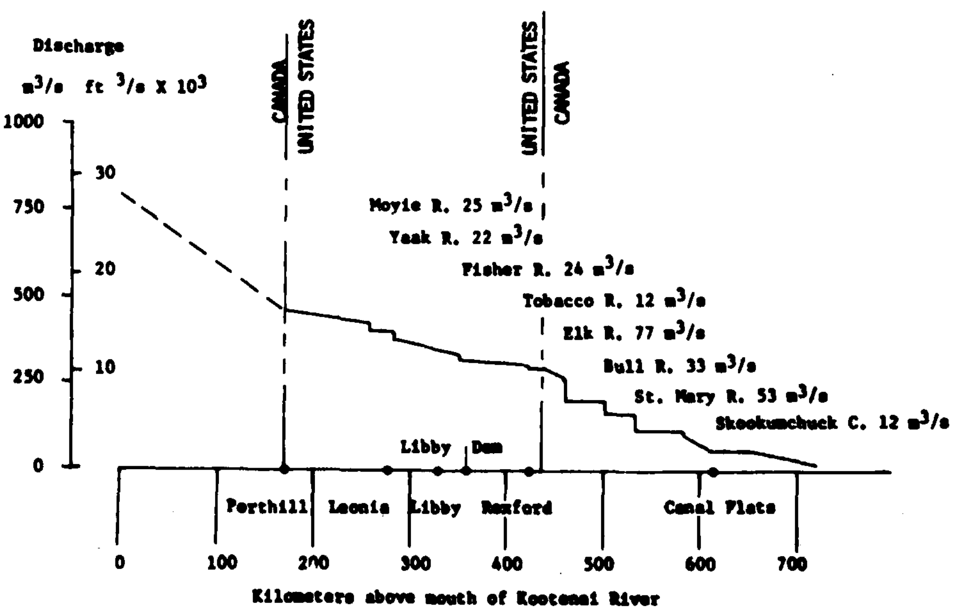


Figure 3. Mean discharge of the Kootenai River and its major tributaries.

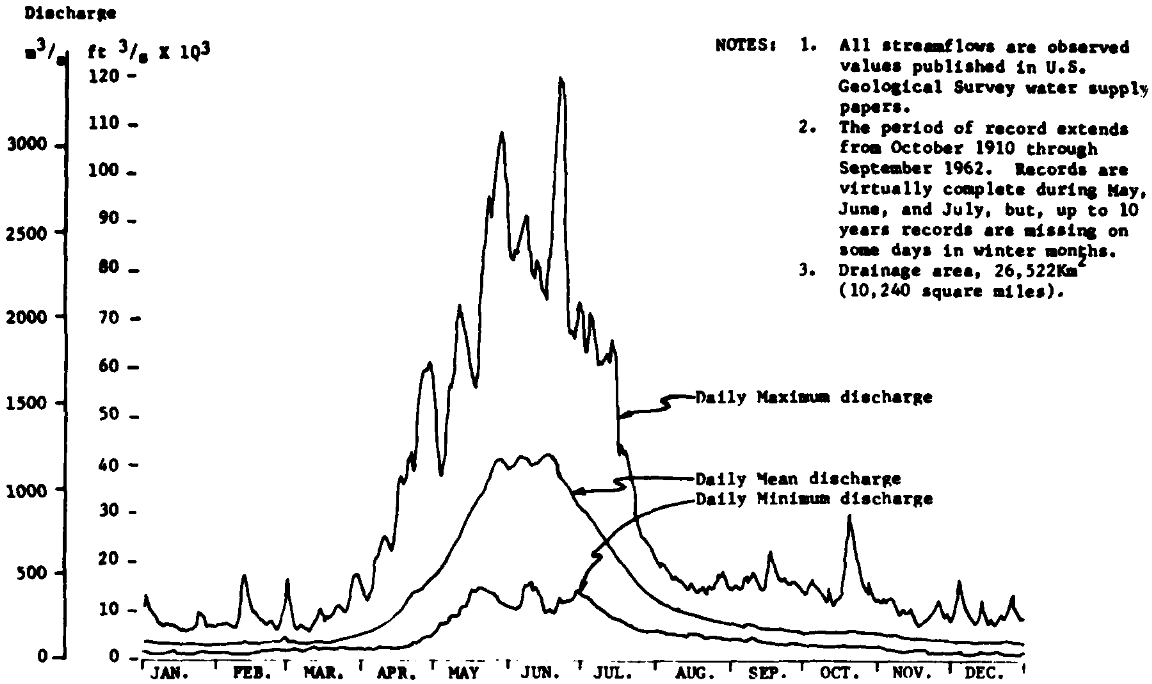


Figure 4. Summary hydrograph for the Kootenai River at Libby, Montana.

2.4.3 Gradient.

A profile of the Kootenai River is shown in figure 5. The total fall from the mouth of the Vermillion River near its source downstream to the Columbia River is 732 m (2,400 ft), which in a distance of 727 km (451 miles) averages 1 m/km (5.3 ft/mile). The steepest parts of the river are between the mouth of the river and Kootenay Lake, where the river drops 105 m (345 ft) in a distance of 26 km (16 miles), and at Kootenai Falls, where the river drops 18 m (60 ft) in 3.2 km (2 miles). A large section of the river extending from Cora Linn Dam, which impounds Kootenay Lake, upstream to Bonners Ferry is virtually flat with the river level at Bonners Ferry being affected by the elevation of Kootenay Lake.

The portion of the river lying in the United States, a distance of 266 km (165 miles), has a fall of 169 m (555 ft) or about 0.6 m/km (3.4 ft/mile). The gradient from Kootenai Falls upstream to the International Boundary is about 0.9 m/km (4.5 ft/mile).

2.4.4 River Bottom and Bank Characteristics.

In general, the river channel up to the high-water mark consists of bottom materials ranging in size from gravel to boulder. The smaller of these materials, due to their instability in periods of high-water velocities, are continually being modified, forming gravel bars and braided channels with alternating pools and riffles. In contrast to upper Kootenai, the lower portion of the river from Bonners Ferry to Kootenai Lake is flat. The river slows and drops its sediment load

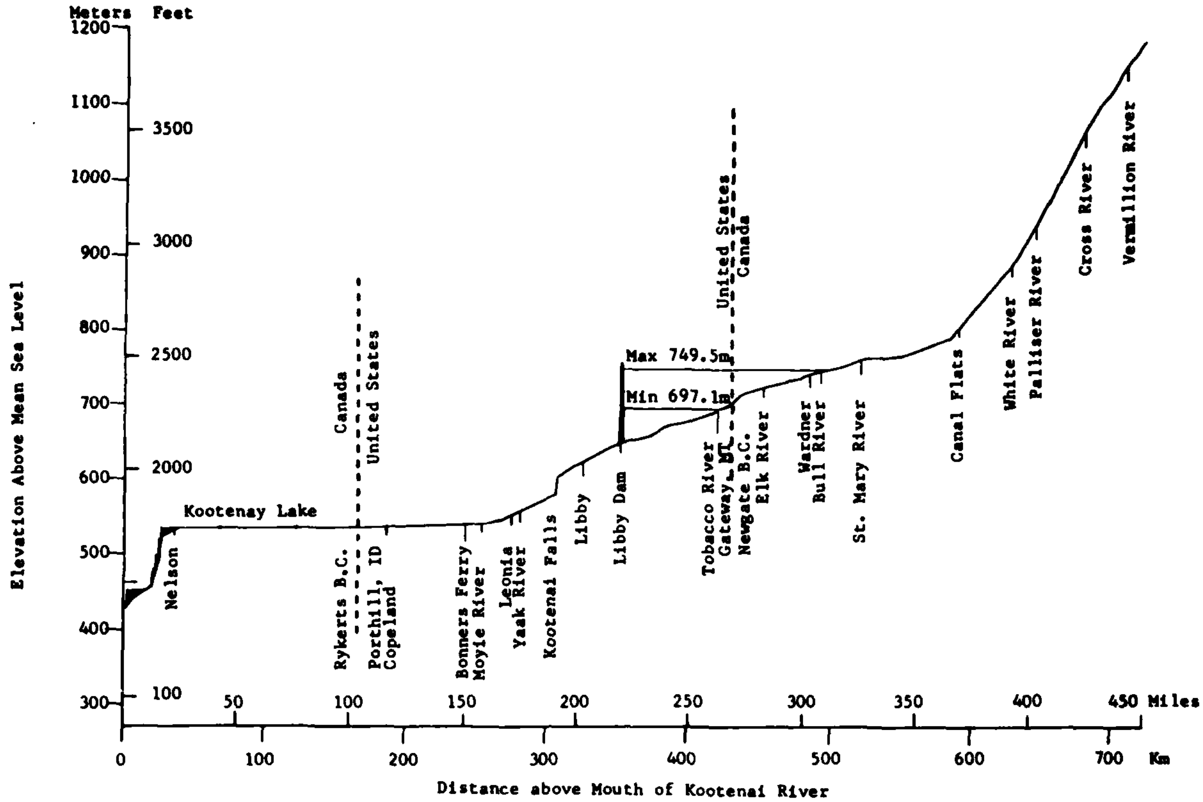


Figure 5. Profile of the Kootenai River.

in this area and, in times of high water, overtops its banks. The dominant bottom type in this area is silt.

2.4.5 <u>Water Use</u>.

Water is one of the most abundant resources in the Kootenai River Basin and is used for a number of purposes, including domestic and industrial supply, waste disposal, power production, irrigation, and recreation.

Water for domestic and industrial purposes in the basin is obtained from both ground water and surface water sources. Some communities such as Eureka and Troy have municipal wells to supplement their surface supplies. Bonners Ferry has solved a problem of insufficient flow in their tributary source by pumping directly from the Kootenai River. The rural population depends almost entirely upon ground water from wells and springs for domestic purposes.

Irrigation represents the major consumptive use in the basin. A report by the Bureau of Reclamation (White, 1960) indicated that only about 2,873 ha (7,100 acres) within the basin boundaries in Idaho and Montana were under irrigation. The depletion was estimated to be about 11.1×10^6 cu m (9,000 acre-ft) of water annually.

Hydroelectric developments existing prior to the construction of Libby Dam consisted of only two small installations which made it necessary for this portion of the basin to import electrical energy. Montana Light and Power, owned by the St. Regis Company, operates a plant on Lake Creek near Troy with a total installed capacity of 4,500 kW and a peaking capacity of 5,350 kW. The community of Bonners Ferry operates a hydro plant on the Moyie River near Moyie Springs with a rated capacity of 2,650 kW and a peaking capacity of 2,850 kW. Both plants are operated as run-of-the-river plants with little or no storage capacity and therefore have little effect upon normal discharge routings in the basin.

Fishing is the most popular recreational use of water in the river and its tributaries. From all indications, fishing pressure is increasing throughout the basin. Fishing through the ice for trout and whitefish is a popular winter sport on the Kootenai River. Bait or fly fishing, either from shore or by boat, occurs the remainder of the year, making fishing a year-round form of recreation on the Kootenai River. Float trips appeal to a small segment of the population and raft trips are a part of Libby's annual "Logger Days." Swimming is done on some of the tributary streams. Furbearers and waterfowl utilize both the mainstem Kootenai and tributaries as well as the lakes of the basin, although trapping of furbearers and waterfowl hunting would be considered a minor use compared to fishing.

Waste Water Sources.

The location and character of point waste discharges within the United States' portion of the basin are indicated in the appendix, table 2. The more significant of these discharges are discussed below.

Municipal Discharges.

Libby, Montana. The treatment plant for Libby serves approximately 3,000 people and consists of a clarifier, heated digester, and chlorine contact tank. Dry weather discharges of 1892.5 cu m/day (0.5 mgd) increase to more than 5677.5 cu m/day (1.5 mgd) during spring runoff. The plant serves only a fraction of the people living within the metropolitan area.

Eureka, Montana. The treatment plant for Eureka serves about 1,100 people and consists of a bar screen, grit chamber, Spiragester (combination clarifier and cold digester), chlorinator and chlorine contact tank. Chlorination is done during the months of June through October.

Bonners Ferry, Idaho. The treatment plant for Bonners Ferry serves about 2,000 people and consists of a series of aerated sewage lagoons with a retention time which averages 25 days. Discharge volume is about 757 cu m/day (0.2 mgd).

Industrial Discharges.

W. R. Grace Company. The W. R. Grace Company mines and processes vermiculite, a siliceous mineral widely used for insulation, from Vermiculite Mountain 11 km (6.8 miles) east-northeast of Libby. Turbid waters resulting from thickening and concentration of the vermiculite and drainage from the tailings formerly caused water quality problems in Rainy Creek and the Kootenai River. In 1971, the mine facilities were expanded and the company constructed a closed-circuit recirculation system. Since that time there has been no discharge from their processing facility although some leaching from the tailings still occurs in the spring of the year.

St. Regis Company. The St. Regis Company operates a lumber and plywood mill in Libby. Sewage wastes are processed by a trickling-filter type plant consisting of a bar screen, primary-secondary clarifier, trickling filter, digester, chlorinator, and chlorine contact tank. Disinfection is done June through October.

While the plant has a capacity of 379 cu m/day (0.1 mgd), the discharge is normally around 227 to 284 cu m/day (0.05 - 0.08 mgd). A large volume of waste water resulting from operation of the log ponds, cooling, and wet stack scrubbers is continually flushed into a large settling pond which merges with the treated sanitary wastes prior to discharge into the Kootenai River. Discharge in 1972 generally ranged from 0.2 to 0.57 cu m/sec (7 to 20 c.f.s.). The company obtains an annual variance to discharge their wastes directly into Libby Creek during cleaning of the settling pond. Included among the characteristics of the log pond wastes is the problem of organic color.

Nonpoint Discharges. Agricultural land occupies only a small fraction of the total land area in the basin and agriculture therefore is believed to be a rather minor pollution source, although it may be significant on certain of the smaller drainages.

Septic systems are widely used throughout the basin and have caused water supply problems in the more populated areas, such as South Libby. The significance of septic systems in relation to groundwater quality and the quality of surface waters in the basin is unknown.

About 90 percent of basin area is classified as forest land and over two-thirds of the basin is classified as commercial forest land or land that is capable of growing an economically harvestable forest crop. No studies concerning the effect of forest practices upon the aquatic environment have been done in this area.

2.4.6 Fishery Resources.

The Kootenai River system, which later was incorporated into Lake Koocanusa, supported a fish population consisting of mountain whitefish, cutthroat trout, rainbow trout, Dolly Varden trout, brook trout, burbot, white sturgeon, kokanee, and a number of associated species. A listing of the species known to occur in the Kootenai River proper is presented in the appendix, table 3. The rainbow, white sturgeon, and kokanee were indigenous to Kootenay Lake and Kootenai River upstream to Kootenai Falls. Brook trout and, likely, the rainbow have been introduced.

Information concerning the status of the fishery prior to 1967 is scarce. Personnel of the Montana Department of Fish and Game have attempted to obtain historic information by contacting "old timers" in the Libby, Rexford, and Eureka areas. They found that these people told essentially the same story - that of a river with a changing fish population.

A number of persons indicated that prior to the late 1940's cutthroat and burbot were the most abundant fish caught, while rainbow were rare and whitefish were seldom caught. Beginning in the early 1950's a major shift in the population occurred. Burbot and cutthroat declined while whitefish and rainbow increased. Some people remarked that distinct changes in water quality accompanied this population shift. Whereas the river substrate had previously been clean and free of attached algae and silt, problems with attached algae (described as moss), silt, and sediment became more noticeable. Sediment loads during the spring appeared larger and more persistent and on occasion the river seemed to develop an odd color.

Creel census data collected by the Montana Department of Fish and Game for the 1949-64 period show relatively good fishing with an overall success rate of from 1.0 to 1.5 fish per man-hour. While the available evidence is scant, and there are differences of opinion as to the quality of fishing that existed prior to construction of Libby Dam, it seems to be a fair appraisal to say that the river and its tributaries provided good fishing in aesthetically pleasing surroundings. The prevailing opinion of the state from the standpoint of fish management during the preconstruction period was that the river and the associated fishery could be left to manage itself with little more than fishing regulations and occasional stocking. Stocking, for the most part, was confined to the tributaries and involved rainbow trout. Fishing pressure was considered to be relatively light.

3.0 WATER QUALITY PROGRAM

The monitoring program agreed upon in 1967 established that the Corps of Engineers would assume responsibilities for water quality monitoring and studies on the Kootenai River above the city of Libby, while the FWPCA would assume monitoring responsibilities for the area from Libby downstream to the International Border.

3.1 Sampling Locations.

The locations of sampling stations on the United States' portion of the Kootenai River and its tributaries are presented below and shown in figure 6.

Stations in the United States:

Station 1: Kootenai River near Rexford, Montana, located 62 km (38.5 miles) upstream of Libby Dam site and 16.9 km (10.5 miles) downstream of the International Border.

Station 2: Kootenai River at Warland, Montana, located 10.7 km (6.6 miles) upstream of Libby Dam site.

Station 3: Kootenai River below Libby Dam, located 6 km (3.7 miles) downstream of Libby Dam site.

Station 4: Kootenai River at Lowry Gulch, located 14.5 km (9 miles) downstream of Libby Dam site.

Station 5: Fisher River.

Station 6: Tobacco River

Station 7: Kootenai River at Libby, Montana, located 28 km (17.4 miles) downstream of Libby Dam site (FWPCA monitoring station).

Station 8: Kootenai River near Leonia, Idaho, located 81 km (50.3 miles) downstream of Libby Dam site (FWPCA monitoring station).

Station 9: Kootenai River near Copeland, Idaho, located 157 km (97.7 miles) downstream of Libby Dam site (FWPCA monitoring station).

Station 10: Kootenai River at Porthill, Idaho, located 187 km (116.3 miles) downstream of Libby Dam site (FWPCA monitoring station).

Station 11: Yaak River.

Station 7 at Libby, Station 8 at Leonia, and Station 10 at Porthill were FWPCA monitoring stations. Chemical sampling was moved from Station 10 at Porthill to Station 9 at Copeland in 1969. The data from these two stations have been combined and are referenced in this report as results of Station 9-10.

The Canadian-U.S.A. Water Quality Task force recommended the following stations receive primary consideration in the development of the joint water quality program:

In the U.S.A.:

Kootenai River near Rexford - (Station 1)
Kootenai River below Libby Dam - (Station 3)
Tobacco River - (Station 6)
Kootenai River near Porthill - (Station 9-10)

In British Columbia:

Kootenay River near Wardner - (Station 17 and 38); Station 17, monitored prior to May 1971 and Station 38 thereafter, located 158.2 km (98.3 miles) upstream of the Libby Dam site.
Bull River - (Station 30)
Elk River - (Station 16)
Kootenay River at Canal Flats - (Station 20); located 257.7 km (160.1 miles) upstream of the Libby Dam site.

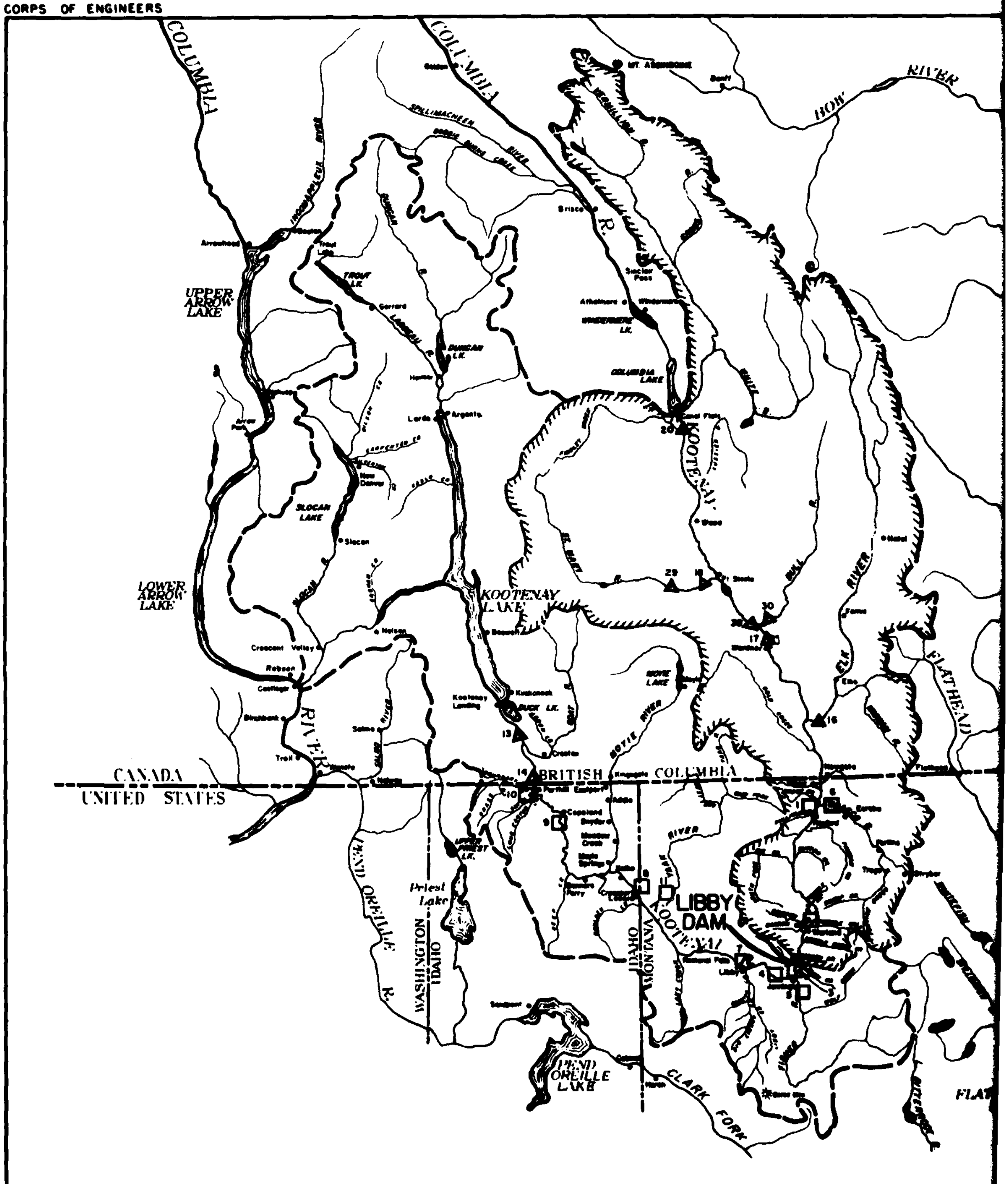
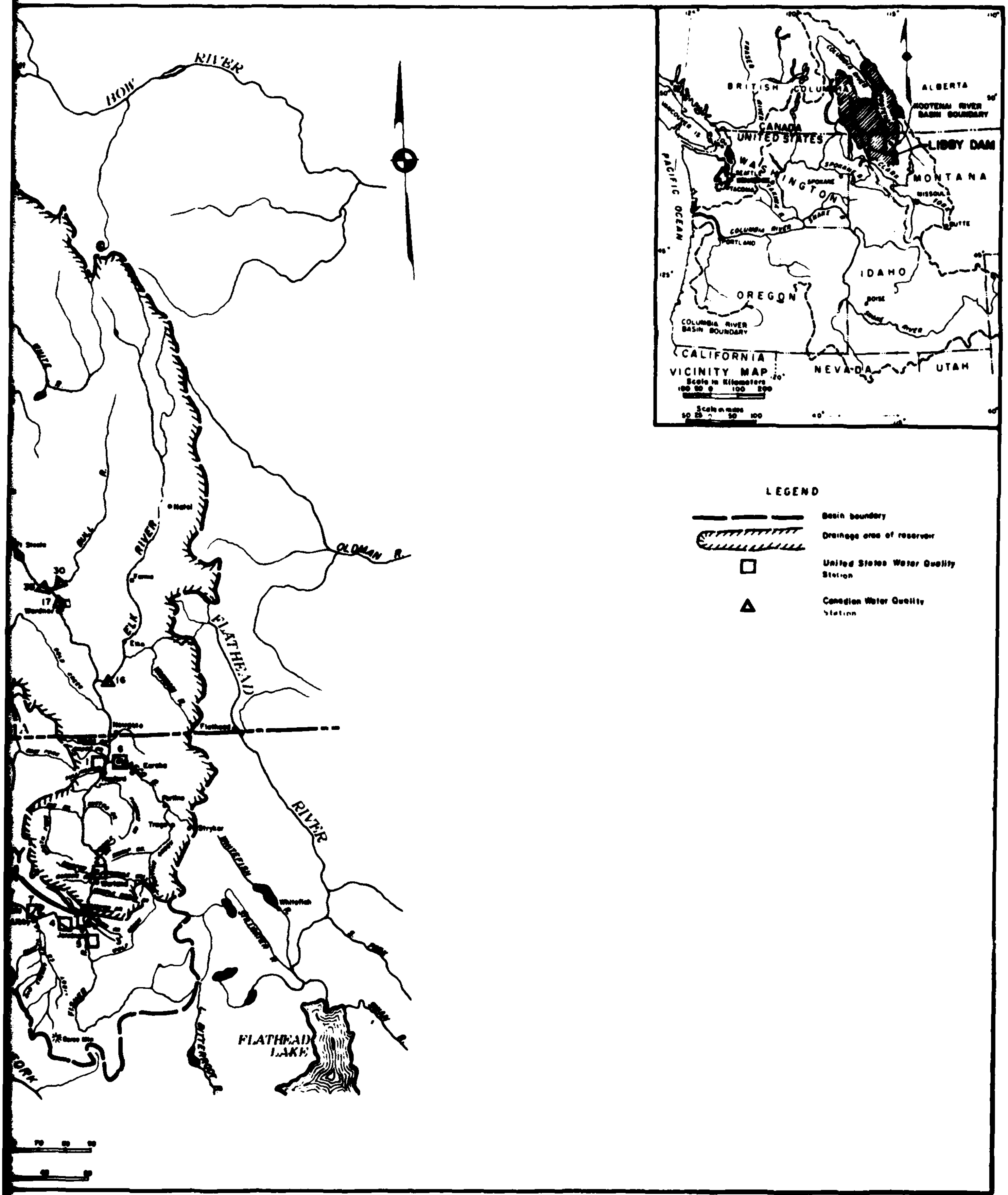


Figure 6. Water quality sampling stations.



BOW RIVER
OLDMAN R.
ELK RIVER
FLATHEAD RIVER
FLATHEAD LAKE
BRITISH COLUMBIA
ALBERTA
KOOTENAI RIVER BASIN BOUNDARY
CANADA
UNITED STATES
LIBBY DAM
MONTANA
WASHINGTON
PACIFIC OCEAN
COLUMBIA RIVER
IDAHO
OREGON
COLUMBIA RIVER BASIN BOUNDARY
CALIFORNIA
NEVADA
UTAH
VICINITY MAP
Scale in Kilometers
LEGEND
Basin boundary
Drainage area of reservoir
United States Water Quality Station
Canadian Water Quality Station

2

Additional Stations Monitored in British Columbia:

Station 29: Upper St. Mary River.

Station 18: Lower St. Mary River.

Station 14: Kootenai River near Porthill, Idaho, located 187 km (116.3 miles) downstream of the Libby Dam site.

Station 13: Kootenai River at Creston Flats, B.C., located 210.2 km (130.6 miles) downstream of the Libby Dam site.

3.2 Methods employed by United States agencies are indicated below.

3.2.1 Discharge.

Stage records were obtained from Stevens A-35 or digital water stage recorders, supplemented by readings from wire-weight gages installed and maintained by the U.S. Geological Survey. Long-term records were available from most stations. The discharge at station 2 was used for station 3 until September 1971. Daily readings from a wire-weight gage installed immediately below the dam plus data from downstream records were used in calculating the discharge for the remainder of the study period.

3.2.2 Water Temperature.

In 1962 the U.S. Geological Survey, under contract with the Corps of Engineers, installed Ryan Thermographs in the Kootenai River at station 2 and station 8. Similar installations were made in the Kootenai River at Waldo, B.C., in the Elk River (station 16), in the Fisher River (station 5) and Yaak River (station 11) in 1963, and below Libby Dam (station 3) in 1968. These data were supplemented by information from a Stevens A-35T Recorder at Porthill (station 10). Problems with freezing prevented year-round use of the Ryan Thermographs and records for complete months extend only from April or May through October or November, missing the colder months of the year.

Thermograph records were supplemented by once-daily or monthly spot observations taken in connection with sediment or chemical samples. Field personnel used calibrated mercury thermometers or a Model FT-3 Marine Hydrographic Thermometer (Applied Research Austin, Inc.).

3.2.3 Suspended Sediment.

Suspended sediment concentrations, expressed as milligrams of dry sediment per liter of the water-sediment mixture, were determined by the U.S. Geological Survey using methodology of Guy and Norman (1970).

3.2.4 Turbidity.

Turbidity was determined from daily suspended sediment samples. Turbidity concentrations were measured with a Hach 2100 Laboratory Turbidimeter. The turbidity of these samples, some of which had been stored up to 30 days or more, was read after 10 seconds agitation.

These data were supplemented by "grab" samples collected during the monthly chemical sampling, or more frequently as necessary, to define specific turbidity problems. A candle turbidimeter used early in the study for field determination by the U.S. Geological Survey was later replaced with a Hach 2100.

3.2.5 Chemical.

Most of the field and laboratory chemical analyses were accomplished by the U.S. Geological Survey under contract with either the Corps of Engineers or FWPCA. Samples collected prior to July 1969 at stations 7 through 10 were analyzed by FWPCA in their Corvallis Laboratory, Corvallis, Oregon. A number of field determinations were made by Corps of Engineers project personnel.

Recognized procedures of sampling and analysis were followed. The U.S. Geological Survey used the methods of Rainwater and Thatcher (1960) until 1969 and Brown, Skougstad and Fishman (1970) throughout the remainder of the study. The FWPCA used methods reported in Analytical Techniques (FWPCA, 1969a) and FWPCA Methods for Chemical Analysis of Water and Wastes (FWPCA, 1969b) with Standard Methods for the Examination of Water and Wastewater, (APHA, 1973) and ASTM Standards, Part 23, Water; Atmospheric Analysis (ASTM, 1966) as basic references. A listing of the methodology employed by the U.S. Geological Survey is included in the appendix, table 4.

A monthly sampling frequency was maintained at all stations except stations 2 and 4, which were primarily aquatic insect sampling stations. Stations 3 and 5 were sampled on a daily schedule from October 1967 through September 1969. 1/ These daily samples were composited on the basis of specific conductance using a discharge - weighted method. Composited periods ranged from 10 to 30 days, necessitating a delay of at least 30 days between sampling and analysis.

All phosphorus and nitrogen determinations have been expressed as P and N, respectively.

Daily loadings were calculated using the formula:
Concentration (mg/l) x mean daily flow (c.f.s.) x 2.447 = Loading (kg/day)

The validity of completed analyses was checked by balancing the chemical equivalents of the major ions. Where the sum of the cations was not within reasonable proximity to the sum of the anions, the determination was rerun. Additional checks were made, wherever possible, by comparing values for dissolved solids with corresponding specific conductance values. The relationship--specific conductance (μmhos) x0.65 ±0.1 = dissolved solids--reported by Rainwater and Thatcher (1960) as being applicable to most waters was used to check the data. Determinations falling outside the above range were rejected.

1/ Water quality characteristics of tributary streams (stations 5, 6, and 11) will be contained in a future report.

Some of the early pH determinations at stations 1 and 3 were done in the laboratory rather than in the field. Although the laboratory data have been included with the analytical field data in the appendix, they were not used in the graphs or for calculation of CO_2. Likewise, total alkalinity as $CaCO_3$, which can be calculated from the laboratory bicarbonate data by multiplying mg/l HCO_3-1 by 0.8202, was not reported as total alkalinity unless the determination was done in the field.

3.2.6 Bottom Fauna.

Bottom fauna sampling was undertaken to determine the existing status of the benthic invertebrate population and to measure any changes occurring during dam construction. Since previous aquatic insect data were not sufficiently definitive for purposes of comparison, and dam construction was already in progress, two control areas above Libby Dam were selected to be compared with two affected areas below the dam. The sites selected were the Kootenai River at Rexford (station 1), at Warland (station 2), below Libby Dam (station 3), and at Lowry Gulch (station 4). Detailed descriptions of each sampling station are contained in the appendix, table 5.

Two different types of samplers were used in the aquatic insect study. The first, used from 1968 through 1971, was a sampler similar to that developed by Waters and Knapp (1961). This sampler was constructed of steel rod with a 9 cm (3.5 in) cutting edge enclosing a sample area of 0.093 sq m (1 sq ft). The framework had a height of 0.52 m (1.7 ft) and was covered with Nitex[1/] netting having a mesh size of 471 microns (38 apertures to the in). Sampling was therefore limited to shallow riffles having a depth less than 0.5 m (1.6 ft). Three samples were collected from each sampling site on each sampling date.

The second method, used only during 1968 and 1969, employed cylindrical substrate samplers as described by Anderson and Mason (1966). These samplers are cylindrical chromium-plated baskets 18 cm (7 in) in diameter and 28 cm (11 in) long filled with coarse native gravels 1.9 to 5.1 cm (0.7 - 2 in) in size. The samples were suspended 1 m (3.3 ft) below the water surface at quarter-points in the river by means of buoys for a period of about 6 weeks as suggested by Mason, Anderson and Morrison (1967). The samples were then lifted, placed in plastic bags and transported to the laboratory where they were washed through a 0.59 mm sieve (U.S. Sieve series 30).

All sorting was accomplished in the laboratory, occasionally using rose bengal as a staining agent to facilitate sorting. Samples were preserved in either 10 percent formalin or 75 percent ethanol. The specimens were identified, to genus if possible, enumerated and the various orders weighed by volumetric displacement.

Fluctuating river levels in spring and early summer and anchor ice in winter occasionally restricted sampling.

1/Trademark of Tobler, Ernst and Traber, Inc.

4.0 RESULTS

Results obtained during the course of the study are summarized below. Detailed data for each parameter and each of the sampling locations can be found in the appendix. Published concurrent with this report is a report by the British Columbia Pollution Control Branch to document the quality of the Kootenai River within Canada prior to river impoundment (Crozier and Leinweber, 1975). The results presented by Crozier and Leinweber are for the period October 1969 through March 1972. To facilitate data comparison, much of the water quality data presented in this report are summarized for two periods of time: before October 1969 and October 1969 through March 1972.

4.1 Physico-Chemical Data.

4.1.1 Discharge.

Comparison of the mean discharge at the Libby gaging station (station 7) for the period 1910-72 with calendar years 1967 through 1971 (table 1) shows that flows 118 to 120 percent of normal characterized the years 1967, 1969, and 1971. The year 1968, with 99 percent of normal, can be considered a normal year. Year 1970 is characterized as a low-water year, with streamflows of only 75 percent of normal. As a whole, flows during the study period appeared only slightly above average. The mean discharge for the study period appeared only slightly above average. The mean discharge for the study period was 366 cu m/sec. (12,922 c.f.s.) or 106 percent of the 345 cu. m/sec. (12,170 c.f.s.) recorded for the 62-year period of record. Annual summaries for other gaging stations, similar to that provided for the Libby gaging station, are presented in the appendix, table 6 through 10. Monthly mean discharges were computed from daily discharge data and are presented in figure 7. Shown in figure 7 is the downstream increase in discharge which occurs due to the influx of both tributaries and ground water, the magnitude of annual

Table 1. Discharge of the Kootenai River at Libby, Montana, 1967-1971.

Discharge		1967	1968	1969	1970	1971	1967-71
		Calendar Year					
Total	m^3/sec-day	149076	124486	151484	93806	149304	
	ft^3/sec-day	5264530	4396170	5349570	3312710	5272610	
Mean	m^3/sec	408	340	415	257	409	366
	ft^3/sec	14420	12010	14650	9076	14450	12922
Maximum	m^3/sec	2172	187	1968	1591	1945	
	ft^3/sec	76700	66200	69500	56200	68700	
Minimum	m^3/sec	60	57	57	47	48	
	ft^3/sec	2110	2000	2000	1650	1700	
Percent 62-yr mean (1910-72; 345 m^3/sec, 12170 ft^3/sec)		118	99	120	75	119	106

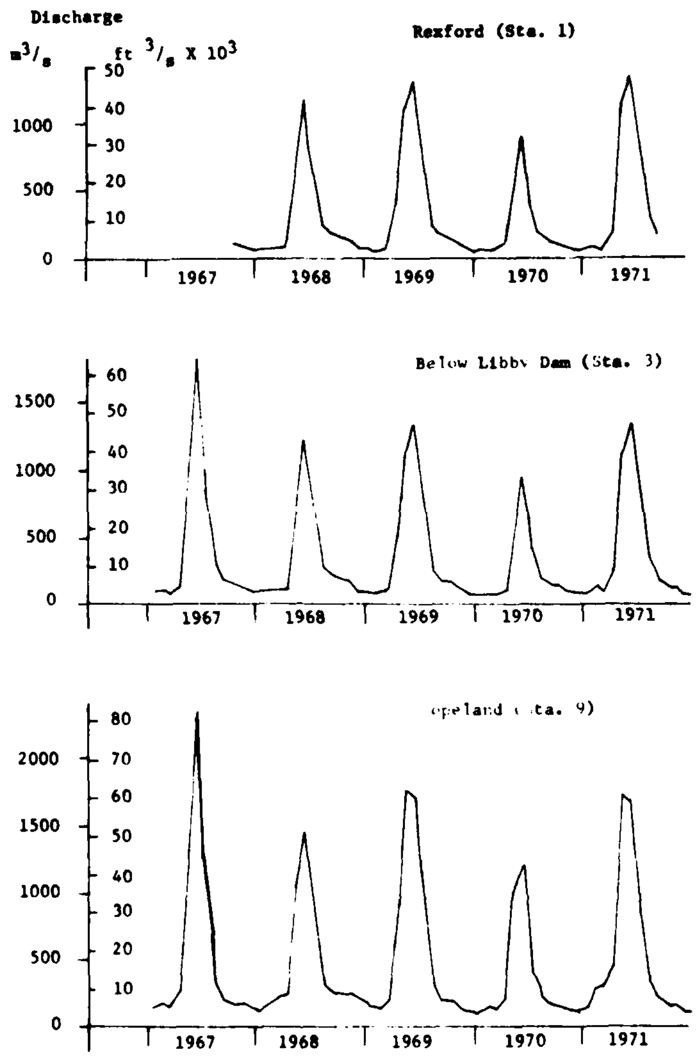


Figure 7. Mean monthly discharge at three stations on the Kootenai River, 1967-1971.

variation in discharge, and the fact that most of the discharge occurs during the months of April, May, and June.

For the years 1967 and 1971, the Kootenai River at Newgate, British Columbia, shortly before it enters the United States, had a mean discharge of 309 cu m/sec (10,906 c.f.s.). At Libby Dam site (station 3), the river had increased in volume to a mean of 341 cu m/sec (12,043 c.f.s.), an increase of 10 percent, indicating that about 90 percent of water passing Libby Dam site is contributed by sources outside of the United States. As the river leaves the United States at Porthill, Idaho (station 10), volume had increased to a mean of 489 cu m/sec (17,274 c.f.s.), or by 58 percent. About 63 percent of the discharge passing station 10 during the years 1967 through 1971 originated in Canada and 37 percent originated in the United States.

Of significance from the physico-chemical and biological standpoints are the large seasonal variations in discharge. Maximum and minimum daily means 1967 through 1971 ranged from 1993 to 37 cu m/sec (70,400 to 1,290 cfs) at Newgate, B.C., and from 2,784 to 74 cu m/sec (98,300 to 2,620 cfs) at Porthill, Idaho. Extremes for the 62-year period of record at Libby range from 3,426 cu m/sec (121,000 c.f.s.) down to 25 cu m/sec (895 c.f.s.), a 135-fold increase between extremes. During the year of study a 40-fold difference between the extremes appeared typical of the upstream stations with a somewhat smaller range at stations further downstream.

4.1.2 Water Temperatures.

Water temperatures of the portion of the river within the United States normally remained at or slightly above freezing from December through February. The development of anchor ice was a common occurrence during the winter with many of the quiet backwaters forming an ice cover. On rare occasions, parts of the river have frozen completely over. Water temperatures increase slowly with the approach of spring, reaching their peak in late July and early August, and decline fairly rapidly in the fall. Water temperatures were normally near 0°C (32°F) about 3 months of the year, above 5°C (41°F) for about 8 months of the year, and above 10°C (50°F) for about 4 months with peak temperatures of about 20°C (68°F).

Annual temperature means for station 10 for calendar years 1964 through 1968 ranged from 7.5°C to 8.4°C (36°-47°F) with a mean for all 5 years of 8.0°C (46.4°F). Although the 1969 data are incomplete, the remaining information does show that mean temperatures during the months of June, July, and August, 1970, and August, 1971, were considerably above normal. The August 1971 mean of 20.1°C (68°F) was the highest monthly mean recorded, not only at station 10, but at all the stations upstream of station 10.

The Kootenai River increases in temperature during spring and summer months with flow downstream; the greatest difference between stations occurred during the month of August when, on the average, the river warmed about 1°C (1.8°F) for each 95 km (59 miles) of length. During the remainder of the year the temperature difference between upstream and downstream stations was less, with the river becoming isothermal during the winter months. While this was the case for mean temperatures, there was considerable daily variation in river temperature, probably due to tributary inflow and local climatic conditions. Some of these variations can be noted in the plots of mean daily temperature in the appendix, figures 2 through 6.

While it is obvious that there is a range of temperature which spans these daily means and that there is considerable year to year difference between monthly and annual means, it should be noted that water temperatures in the river do follow a fairly consistent, predictable pattern which varies little from year to year. Figure 8 shows the deviation between temperature extremes and the 1962-1971 mean.

Spot observations of river temperature made between 1967 and 1972 are graphed in figure 9. Other than normal annual fluctuations, no long-term trends were indicated during the period of study.

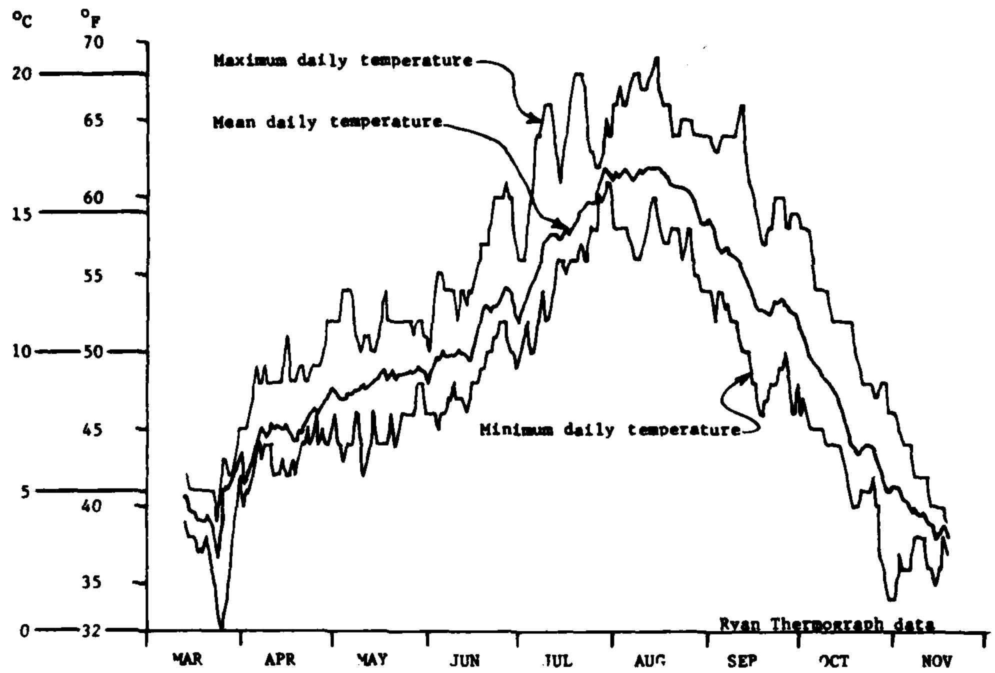


Figure 8. Summary thermograph for the Kootenai River at Warland, Montana, 1962-1971.

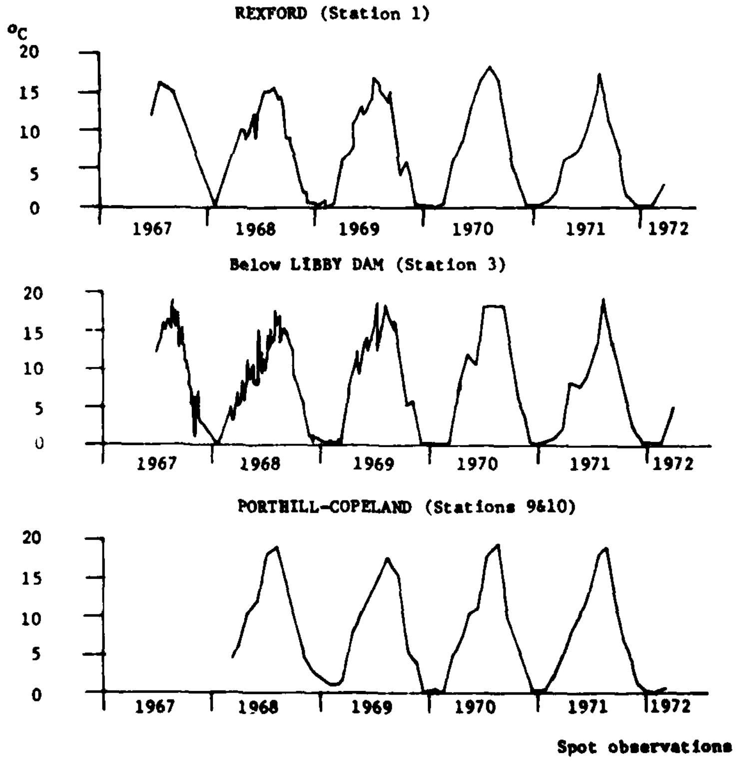


Figure 9. Water temperatures at three locations in the Kootenai River, 1967-1972.

4.1.3 Suspended Sediment.

Between October 1967 and September 1971 the Kootenai River, near station 1, contained a mean (time-weighted) suspended sediment concentration of 39 mg/l. Concentrations increased to a mean of 47 mg/l, or by 21 percent, at station 3, dropping to 34 mg/l near station 9. Discharge-weighted means, although considerably higher than the time-weighted means, follow much the same pattern with values of 115, 140, and 108 mg/l respectively. Individual determinations ranged from 1 to 1,200 mg/l with high concentrations coinciding with periods of peak discharge. Calendar year values (tables 2, 3, and 4) show that concentrations during a year of high water (i.e. 1969) were as much as 2-1/2 times the mean found during a low water year (i.e. 1970). These differences among years are depicted in a graph (figure 10) of monthly mean (time-weighted) concentrations. Graphs comparing daily concentrations of suspended sediment are presented in the appendix, figures 7 through 11. These data reveal that, with the exception of high concentrations created below Libby Dam during periods of peak discharge in 1968 and 1969, there was little difference in suspended sediment concentrations being carried by the river at any of the stations sampled.

The suspended sediment load as calculated from daily samples and mean daily discharges for the period October 1967 through September 1971 totaled 4.7 x 10^6 metric tons[1/] at station 1. This increased to 5.8 x 10^6 metric tons at station 3 and 6.3 x 10^6 metric tons at station 9. Mean daily loads were 3,242 metric tons at station 1, 3,562 at station 2, and 3,866 at station 9. This amounts to an increase of 1.1 x 10^6 metric tons, or 10 percent, between stations 1 and 3, and 5 x 10^5 metric tons, or a 9 percent increase, between stations 3 and 9.

Table 2. Suspended sediment concentrations and loadings for the Kootenai River near Rexford, Montana (Station 1), October 1967 - September 1971.

	Calendar Year			Period
Concentration	1968	1969	1970	Oct 67-Sep 71
Mean (time-weighted) mg/l	36	46	21	39
Mean (discharge-weighted) mg/l	104	134	54	115
Maximum daily, mg/l	870	537	223	870
Minimum daily, mg/l	3	1	2	1
Loadings				
Total, tons (metric)[1/]	1,040,118	1,620,937	386,878	4,736,800
Mean daily, tons (metric)[1/]	2,842	4,441	1,060	3,242
Maximum daily, tons (metric)[1/]	136,080	81,557	27,125	136,080
Minimum daily, tons (metric)[1/]	23	7	13	7

1/Metric tons x 1.102 = tons (short)

Table 3. Suspended sediment concentrations and loadings for the *Kootenai River below* Libby Dam (Station 3), October 1967 - March 1972.

Concentration	Calendar Year 1968	1969	1970	1971	Period Oct 67-Sep 71	Oct 67-Mar 72
Mean (time-weighted) mg/l	49	68	21	47	47	43
Mean (discharge-weighted) mg/l	139	198	57	131	140	135
Maximum daily mg/l	1,200	851	213	692	1,200	1,200
Minimum daily mg/l	1	1	2	2	1	1
Loadings						
Total, tons (metric)1/	1,414,871	2,423,433	429,283	1,561,880	5,842,376	5,856,103
Mean daily, tons (metric)1/	3,866	6,640	1,176	4,279	3,999	3,562
Maximum daily, tons (metric)1/	182,347	144,245	24,676	113,400	182,347	182,347
Minimum daily, tons (metric)1/	11	8	7	12	7	7

1/Metric tons x 1.102 = tons (short)

Table 4. Suspended sediment concentrations and loadings for the Kootenai River near Copeland, Idaho (Station 9), October 1967 - March 1972.

Concentration	Calendar Year 1968	1969	1970	1971	Period Oct 67-Sep 71	Oct 67-Mar 72
Mean (time-weighted) mg/l	27	46	20	47	34	31
Mean (discharge-weighted) mg/l	76	135	65	134	108	104
Maximum daily mg/l	573	580	211	515	583	583
Minimum daily mg/l	1	1	1	1	1	1
Loadings						
Total tons (metric)1/	1,046,749	2,359,103	666,825	2,224,659	6,298,772	6,356,956
Mean daily tons (metric)1/	2,860	6,463	1,827	6,095	4,311	3,866
Maximum daily tons (metric)1/	106,142	117,936	45,179	92,534	117,936	117,936
Minimum daily tons (metric)1/	9	14	7	6	6	6

1/Metric tons x 1.102 = tons (short)

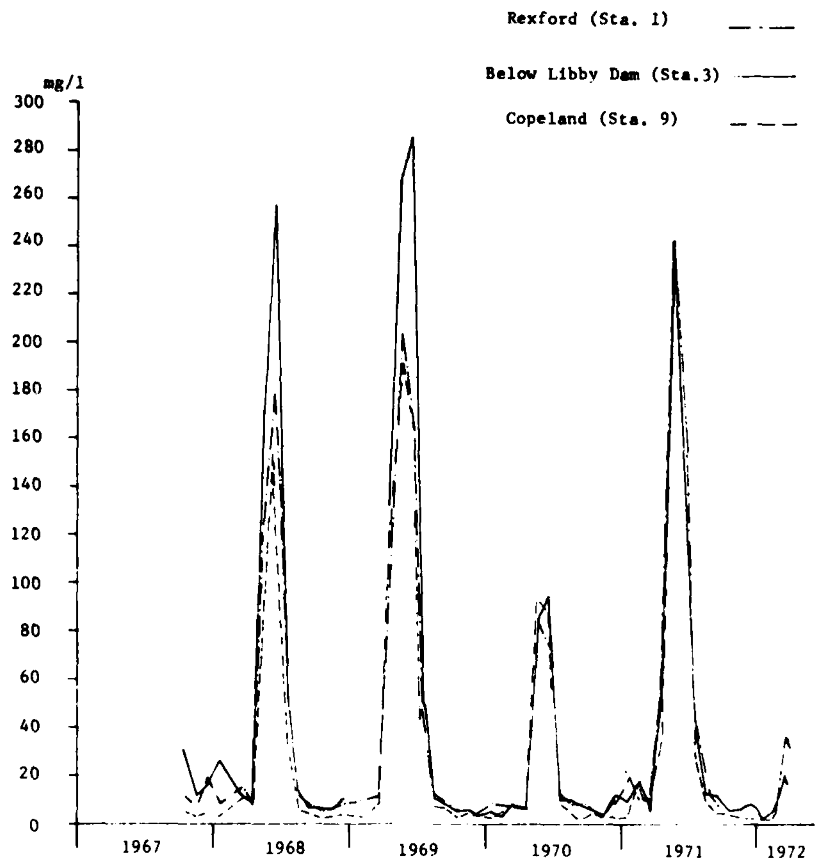


Figure 10. Monthly mean suspended sediment concentrations.

An overall increase of 1.5×10^6 metric tons, or 19 percent, in sediment loading is therefore indicated for the section of the river between Rexford, Montana, and Copeland, Idaho.

Comparison of the data for each of the three stations (tables 2 through 4) shows considerable year to year variation. In 1968, which is considered a normal year in terms of discharge, the Kootenai River at station 1 carried a total suspended load of 1.0×10^6 metric tons. In 1969, a high-water year, the load increased to 1.6×10^6 metric tons, or by 60 percent. In the year which followed, this dropped to slightly under 4×10^5 metric tons, or by 76 percent, demonstrating the cumulative effect that increases and decreases in discharge have upon sediment loadings. Values for station 3 were consistently higher than station 1 with 1.4×10^6 metric tons in 1968, 2.4×10^6 in 1969, and 4.3×10^5 in 1970. Suspended sediment values for station 9 were lower than station 3 with a load of 1.0×10^6 metric tons in 1968, nearly the same with about 2.4×10^6 metric tons in 1969, and considerably higher in 1970 and 1971 with 7×10^5 and 2.2×10^6 metric tons respectively.

The fluctuation in suspended sediment loading among the three stations is shown in table 5. Particularly large increases of 3.7×10^5

Table 5. Amount of downstream change in the suspended sediment load carried by the Kootenai River, October 1967-March 1972.

Inclusive Dates	Metric Tons[1/] Difference Between Sta. 1 and Sta. 3	Sta. 3 and Sta. 9	Sta. 1 and Sta. 9
Oct 1967 - Dec 1967	+ 8,405	- 13,904	- 5,499
Jan 1968 - Dec 1968	+374,753	-368,122	+ 6,630
Jan 1969 - Dec 1969	+802,497	- 64,330	+738,166
Jan 1970 - Dec 1970	+ 42,405	+237,542	+279,946
Jan 1971 - Sep 1971	-122,412	+665,140	+542,720
Oct 1967 - Sep 1971	+1,105,647	+456,325	+1,561,972
Oct 1971 - Dec 1971		- 2,361	
Jan 1972 - Mar 1972		+ 46,925	
Oct 1967 - Mar 1972		+500,889	

1/Metric tons x 1.102 = tons (short)

and 8.0 x 10^5 metric tons can be noted between stations 1 and 3 in the years 1968 and 1969. These increases were not reflected in the data for station 9 in 1968 and did not become apparent there until 1969, 1970, and 1971.

It is evident from the data presented that there was a considerable increase in suspended sediment below Libby Dam, particularly during the period of high discharge in the years 1968 and 1969. The greater part of the increase at station 3, which amounted to almost 1.2 x 10^6 metric tons during the 1968-69 period, is believed to have been, in large part, caused by river diversions necessitated by first- and second-stage cofferdam construction at the Libby Dam Project. These diversions, which were completed in November 1967 and November 1968, caused only short-term increases as they were completed during periods of low flows. Spring runoff, however, with increased volumes and velocities, resorted the bottom materials in the vicinity of these diversions. This placed in suspension large quantities of sediment, almost all of which was silt, being of a grain-size of 0.25 mm or smaller (appendix, table 21). The decrease of 1.2 x 10^5 metric tons between stations 1 and 3, January through September 1971, resulted from settling of material in suspension in the small pool that was created behind the dam in 1971. The apparent delay in the quantity of sediment being carried by the river between stations 3 and 9 deserves further study.

4.1.4 Turbidity.

Daily turbidity determinations below Libby Dam (station 3) for the period extending from March 1968 through March 1972 are presented in the appendix, tables 24 through 28. These data are supplemented

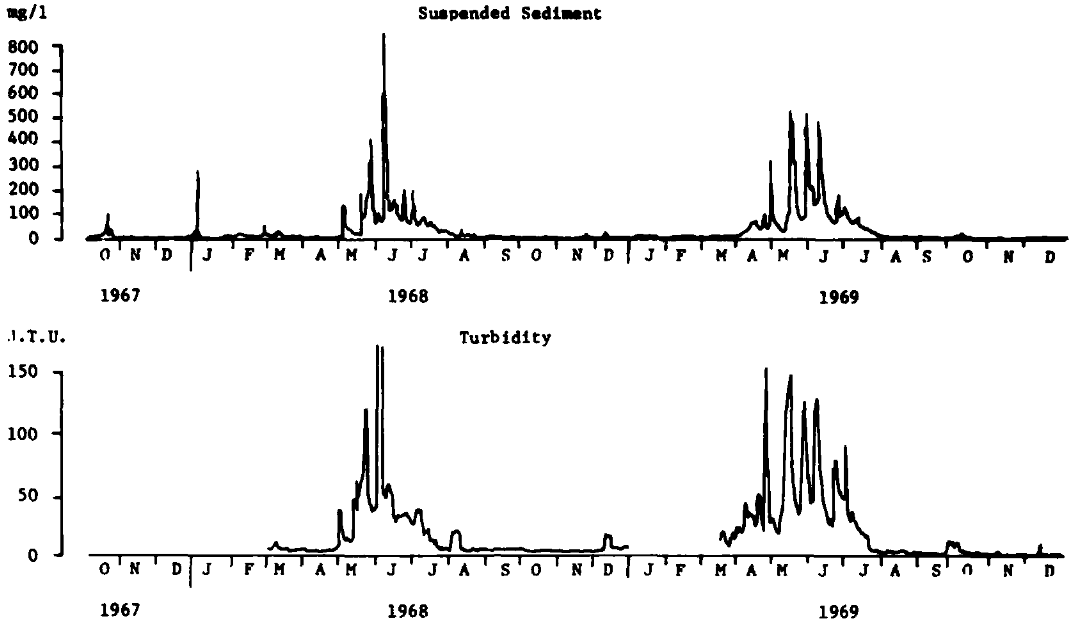


Figure 11. Suspended sediment concentrations and turbidity in the Kootenai River below Libby Dam, October 1967-December 1969.

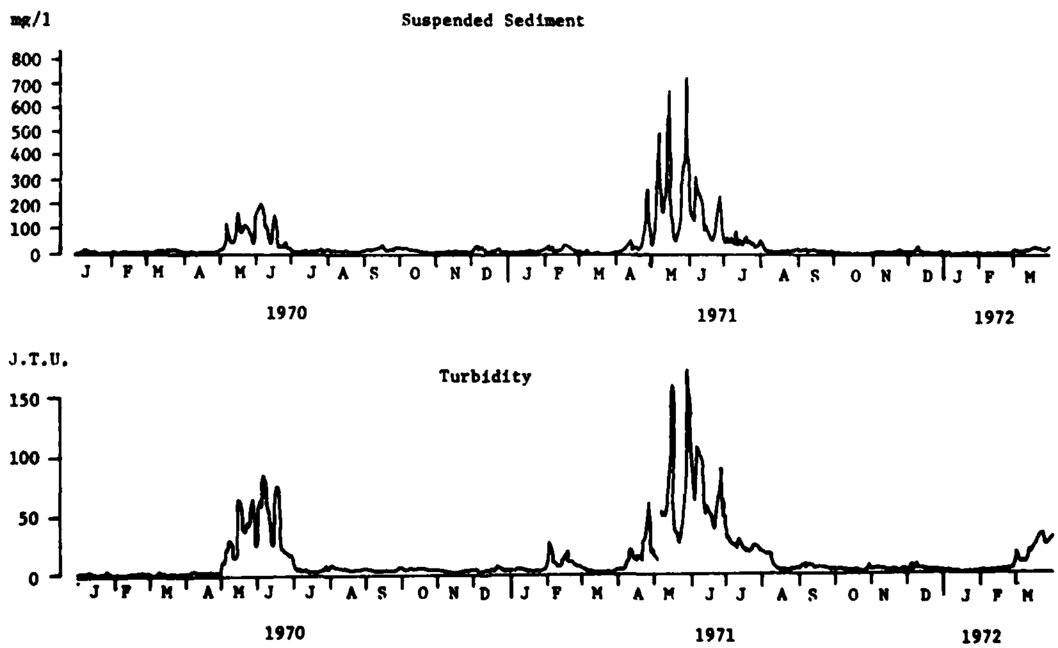


Figure 12. Suspended sediment concentration and turbidity in the Kootenai River below Libby Dam, January-March 1972.

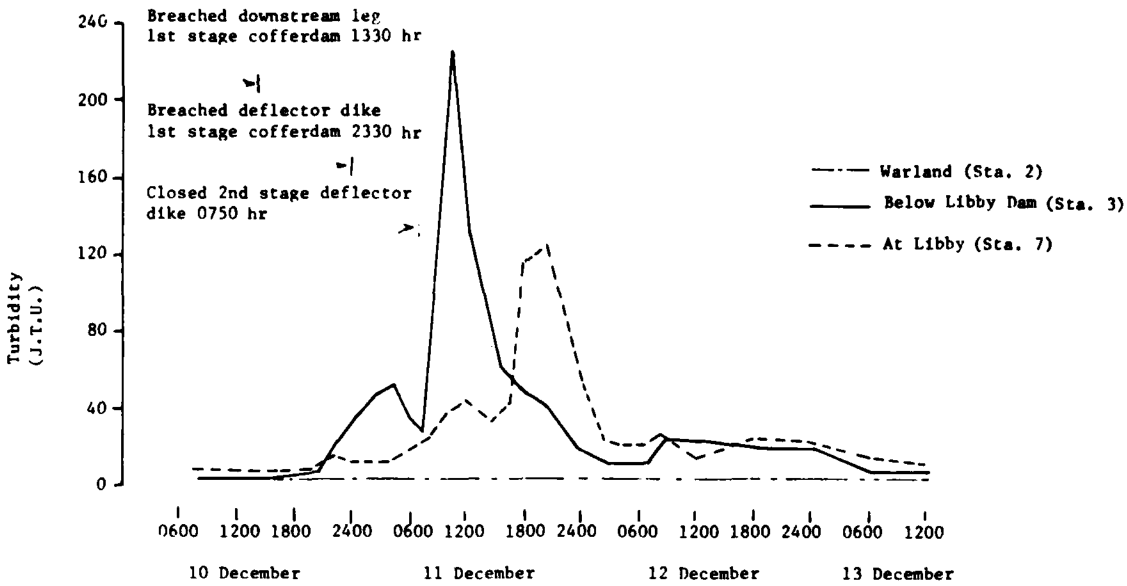


Figure 13. Turbidity created during second-stage diversion, 10-13 December 1968.

by monthly and miscellaneous observations (appendix tables 29 through 32) made both above and below the dam to define specific problems.

Turbidity values below the dam site closely paralleled the trends shown for suspended sediment concentrations (figures 11 and 12) and typically remained at about five units or less during periods of base flow. Large increases, at times exceeding 100 turbidity units, appeared only during the spring runoff. Maximums of over 170 units occurred below the dam in June 1969. Occasional freshets and major construction activities created short-term turbidities usually of 25 units or less.

The highest turbidity recorded during the study was 225 units on 11 December 1968 during second-stage diversion of the river. Turbidity readings taken both above and below the diversion are presented in the appendix, table 33, and graphed in figure 13. The peak of the slug which passed station 3 at 1025 hours 11 December was encountered at station 7, 22.2 km (13.8 miles) downstream, almost 10 hours later. The peak of the slug dropped from 225 turbidity units at station 3 to 125 units at station 7, or by 56 percent during this period. The slug widened considerably in downstream flow. A somewhat similar pattern was indicated during drainage of the contractor's settling pond 25-26 November 1969 (appendix, table 34). In both operations, turbidity levels returned rather quickly to normal background levels.

A comparison of monthly turbidity determinations is shown below:

			Formazin Turbidity Units		
Location	Period	n	Maximum	Minimum	Mean
Sta. 1	Oct 69 - Mar 72	30	43	0	6
Sta. 3	Oct 69 - Mar 72	30	75	1	10
Sta. 9-10	Apr 68 - Sep 69	15	32	0	6
	Oct 69 - Mar 72	23	30	0	4

These data indicate a mean increase of four turbidity units between stations 1 and 3 for the period October 1969 through March 1972 and a mean decrease of six units between station 3 and 9-10, giving a mean decrease of two units between stations 1 and 9-10.

A summary of daily turbidity determinations at station 3 covering the period from March 1968 through March 1972, except for a 2-1/2 month period in January to March 1969, is shown below:

Location	Period	n	Formazin Turbidity Units Maximum	Minimum	Mean
Sta. 3	Mar - Dec 1968	306	175	2	15
	Mar - Dec 1969	290	150	1	22
	Jan - Dec 1970	365	83	1	9
	Jan - Dec 1971	365	160	1	17
	Jan - Mar 1972	91	30	1	8
	Mar 68-Mar 72	1,417	175	1	15

While some statistical problems exist in evaluating the turbidity, or relative transparency, of the river and the downstream changes which have occurred, it is evident from the data that the river is naturally turbid during the high-water period and particularly during years of extremely high flows. Construction activities undoubtedly increased the turbidity of the river, but the increases appeared limited to periods of high discharge, to occasional short-term additions during periods of low flow, and to the early years of the study when the major foundation work and river diversions were being done at the Libby Dam project. Even with the increased turbidity caused by the construction of Libby Dam and related road and railroad relocations on the Fisher River, monthly turbidity determinations at Porthill-Copeland showed the water to be less turbid (more transparent) on the average than the water found near Rexford.

4.1.5 Color.

True color of a water sample was determined after the sample was clarified by centrifugation to remove turbidity. The color is attributable to the presence of such constituents in the water as metallic ions, plankton, and plant residues. The color of the Kootenai River ranged from 0 to 25 Platinum-Cobalt (Pt-Co) color units throughout the study period. Values of five units or less were generally characteristic of the water, except for the months of May and June when the color increased to maximums of from 10 to 25 units. Other than these seasonal fluctuations, which coincided with periods of high discharge, the color data exhibited no particular temporal trends which might be indicative of changing conditions in the section of the river within the United States.

Location	Period	n	Pt-Co Units Maximum	Minimum	Mean
Sta. 1	Jun 67 - Sep 69	23	12	1	3
	Oct 69 - Mar 72	29	15	0	5
Sta. 3	Jun 67 - Sep 69	16	10	1	4
	Oct 69 - Mar 72	30	20	0	5
Sta. 9-10	Oct 69 - Mar 72	23	10	0	5

The above data show a small increase occurred in water color between station 1, with a mean of three units, and stations 9-10 with a mean of eight units during the early phases of the study. A mean of five units characterized all stations during the latter phase, October 1969 through March 1972.

4.1.6 Dissolved Oxygen.

Dissolved oxygen concentrations in the section of the Kootenai River under study were generally high, covering a range of from 8.0 to 14.9 mg/l, and were typically near saturation, ranging from 87 to 122 percent saturation. Concentrations of 10 mg/l or more were characteristic of the river during all but the warmest months of the year. As dissolved oxygen concentration fluctuates inversely with water temperature, the concentrations follow a definitive pattern of seasonal change. Figures 14 and 15 show the magnitude of these fluctuations.

While there appear to be slight differences between upstream and downstream sampling stations, there is no evidence of any long-term temporal trends at any of the stations sampled.

Comparison of the dissolved oxygen data from station 1 with the downstream stations for the period October 1969 through March 1972 shows a progressive downstream increase between stations 1 and 3 and stations 7 and 8 with a decline noted only between stations 8 and 9-10.

			mg/l Dissolved Oxygen (% Saturation)		
Location	Period	n	Maximum	Minimum	Mean
Sta. 1	Oct 69 - Mar 72	30	13.4 (108)	8.4 (87)	11.5 (99)
Sta. 3	Oct 69 - Mar 72	30	14.6 (117)	8.4 (87)	11.9 (103)
Sta. 7	Oct 69 - Mar 72	30	14.5 (119)	8.4 (87)	11.9 (103)
Sta. 8	Oct 69 - Mar 72	30	14.9 (120)	10.1 (99)	12.7 (109)
Sta. 9-10	Oct 69 - Mar 72	30	14.8 (117)	9.0 (96)	12.1 (104)

The mean concentration of 11.5 mg/l at station 1 increased to 12.7 mg/l at station 8 and dropped to 12.1 mg/l at station 9. Percent saturation increased from 99 percent at station 1 to 109 percent at station 8 and dropped to 104 percent at station 9-10. Such differences between the stations are neither particularly large nor of a magnitude where a water quality problem is suspect. High oxygen concentrations in the river indicate the river was not only able to satisfy the high respiratory demands of desirable species of adequate life but also was able to satisfy demands placed on the resource by industrial and domestic waste discharges.

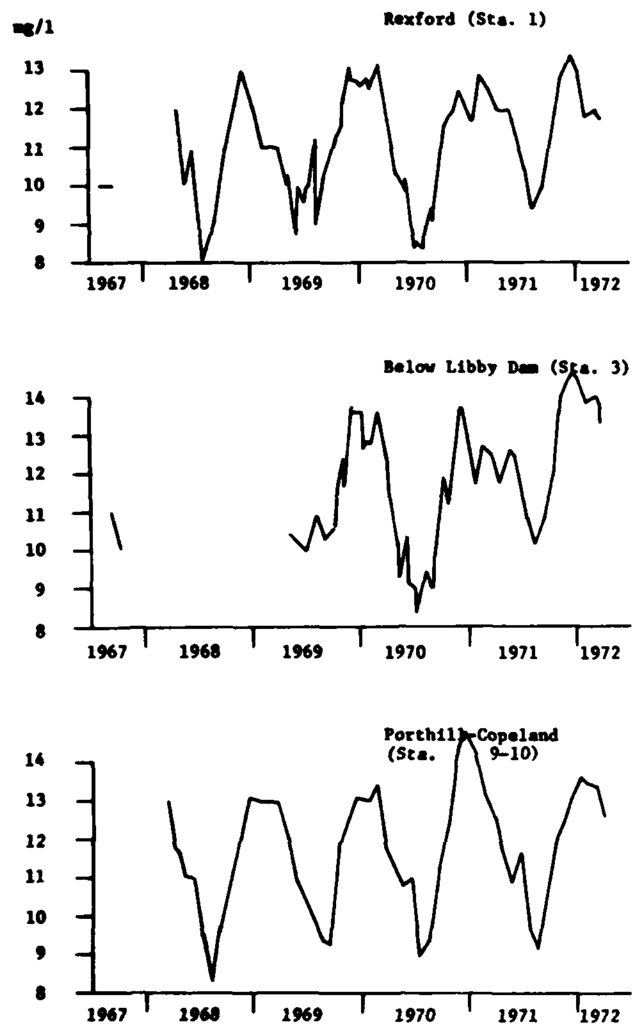


Figure 14. Dissolved oxygen concentrations in the Kootenai River, 1967-1972.

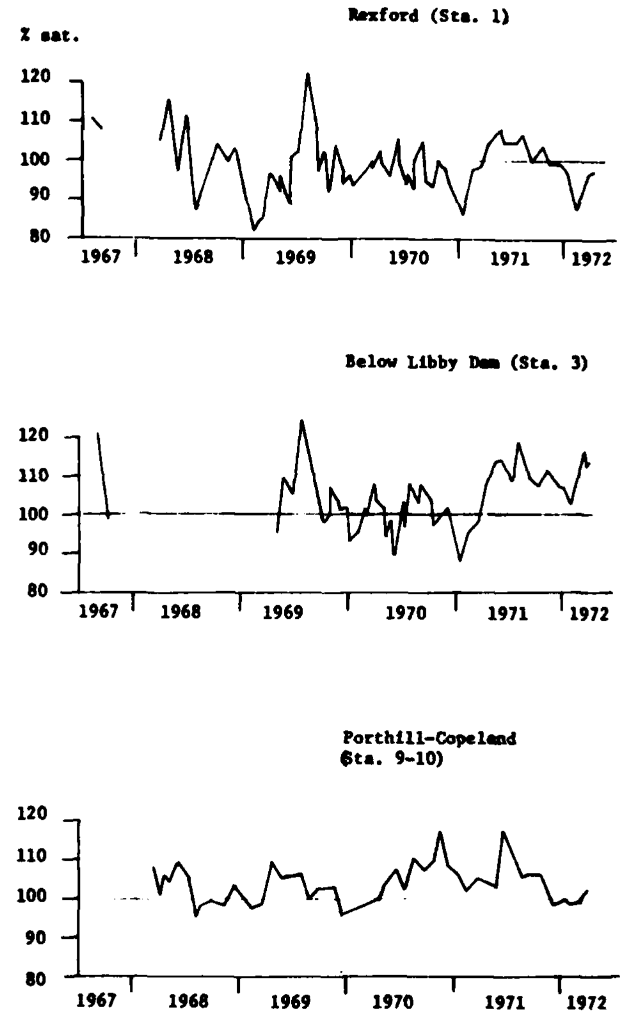


Figure 15. Dissolved oxygen percent saturation in the Kootenai River, 1967-1972.

4.1.7 Biochemical Oxygen Demand (BOD).

BOD determinations were done concurrent with dissolved oxygen determinations at three of the downstream stations. The results showed oxygen demands ranging from 0.1 to 4.9 mg/l for the river as a whole, with means of 1.2 mg/l at station 7, 2.0 mg/l at station 8, and 1.6 mg/l at station 9-10.

Location	Period	n	mg/l BOD Maximum	Minimum	Mean
Sta. 7	Oct 69 - Mar 72	30	4.8	0.3	1.2
Sta. 8	Oct 69 - Mar 72	29	4.9	0.5	2.0
Sta. 9-10	Oct 69 - Mar 72	30	3.7	0.1	1.6

The mean BOD at station 8 (2.0 mg/l), which lies downstream from the communities of Libby and Troy, was slightly higher than the 1.2 mg/l at station 7, which is representative of the river above Libby, and the 1.6 mg/l at station 9-10, as the river leaves the United States.

4.1.8 Total Organic Carbon (TOC).

TOC determinations were made at stations 7, 8, and 9-10 beginning in June 1968, but were not begun at stations 1 and 3 until October 1970. Comparison was therefore based on two separate time periods as shown below:

Location	Period	n	mg/l TOC Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	16	14	0	4
Sta. 3	Oct 70 - Mar 72	17	18	0	5
Sta. 7	Jun 68 - Sep 70	27	15	0	3
	Oct 70 - Mar 72	12	58	0	11
Sta. 8	Jun 68 - Sep 70	19	12	0	3
	Oct 70 - Mar 72	11	3.5	0	2
Sta. 9-10	Jun 68 - Sep 70	22	14	0	3
	Oct 70 - Mar 72	11	3	1	1

TOC was generally found to be 5 mg/l or less with only occasional higher values. Means at stations 7, 8, and 9-10 were 3 mg/l from June 1968 through September 1970. Higher values of 4 and 5 mg/l were found at stations 1 and 3, respectively, during the period October 1970 through March 1972. Two extremely high determinations of 58 mg/l on 13 October 1970 and 36 mg/l on 9 December at station 7 were recorded. The two high values coincided with high values for BOD at station 7. Graphs of total organic carbon for stations 1, 3, and 9-10 are presented in figure 16.

4.1.9 pH.

The pH of the Kootenai River was generally within a range of pH 7.0 to 9.0. Field determinations of pH at stations 1, 3, and 9-10 are shown in graphic form in figure 17.

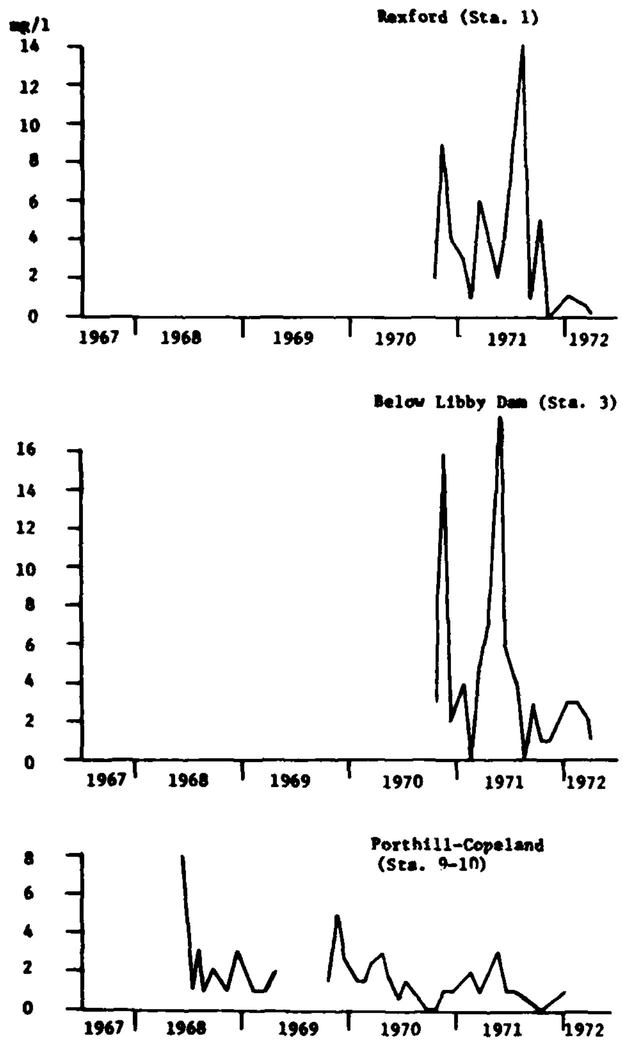


Figure 16. Total organic carbon concentrations in the Kootenai River, 1967-1972.

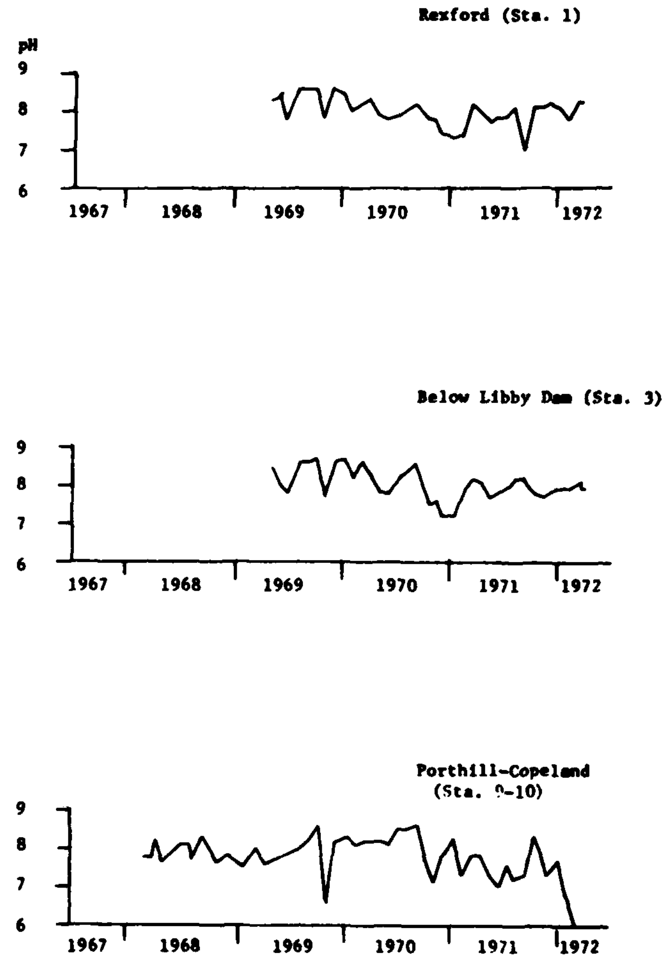


Figure 17. pH of the Kootenai River, 1967-1972.

Dominating features of the pH data are the irregular short-term fluctuations of the monthly observations developing into what appears to be evidence of a long-term, downward trend. A downstream decrease in pH as the river traverses the United States is evident. Some of the short-term fluctuations, such as the decline noted in late 1970 and early 1971, appear to be characteristic of the river system as a whole in that the pH was noted to decline at each of the sampling stations. Other fluctuations seem to be purely local in nature with low pH at only one or two of the stations while the values elsewhere were high. The abrupt decline to a pH of 6.0 at station 9 in March 1972, which happens to be the minimum pH value found during the study, fits the latter category.

While the specific causes of these local short-term changes in pH are difficult to evaluate, it should be noted that the pH at all stations was generally high and at no time did it enter the range where it might be expected to have a detrimental effect upon water uses and aquatic life.

4.1.10 Total Alkalinity - Bicarbonates.

Field analyses of total alkalinity, expressed as $CaCO_3$, ranged from 54 mg/l to 152 mg/l in the portion of the Kootenai River under study. Maximum, minimum, and mean total alkalinities at three of the sampling locations are shown below:

			mg/l Total Alkalinity as $CaCO_3$		
Location	Period	n	Maximum	Minimum	Mean
Sta. 1	Oct 69 - Mar 72	28	152	75	115
Sta. 3	Oct 69 - Mar 72	28	142	66	110
Sta. 9-10	Mar 68 - Sep 69	17	114	59	83
	Oct 69 - Mar 72	30	122	54	98

Comparison shows that the total alkalinity of the river decreased from a mean of 115 mg/l at station 1 to 98 mg/l at station 9 during the period from October 1969 through March 1972.

Prior to October 1969, alkalinity determinations for stations 1 and 3 were analyzed in the laboratory and reported as bicarbonate (HCO_3^-) and carbonate ($CO_3^=$) ions. At other stations alkalinities as $CaCO_3$ were reported. For purpose of comparison, alkalinities were converted to bicarbonate ions. The resultant bicarbonate data, which combine both field and laboratory analyses, are shown in graphic form in figure 18.

This information shows that bicarbonate concentrations fluctuated seasonally during the preimpoundment period with highest concentrations occurring during periods of base flow in midwinter and lowest concentrations occurring during the period of peak runoff in the late spring. Water entering the United States near station 1 normally had a higher bicarbonate content and thus a higher "buffering" capacity than waters leaving the United States. The downstream decrease was progressive, implicating tributary dilution with waters of lower alkalinity. It is significant to note that the highly alkaline concrete wastes from dam construction had little, if any, effect upon the rivers' bicarbonate concentration.

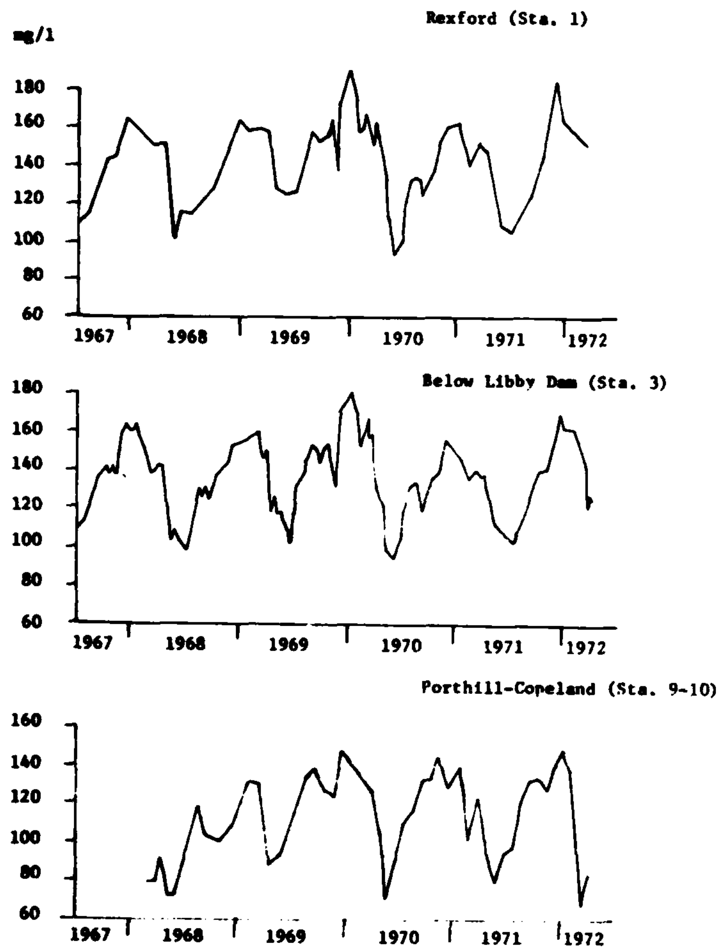


Figure 18. Bicarbonate concentrations in the Kootenai River, 1967-1972.

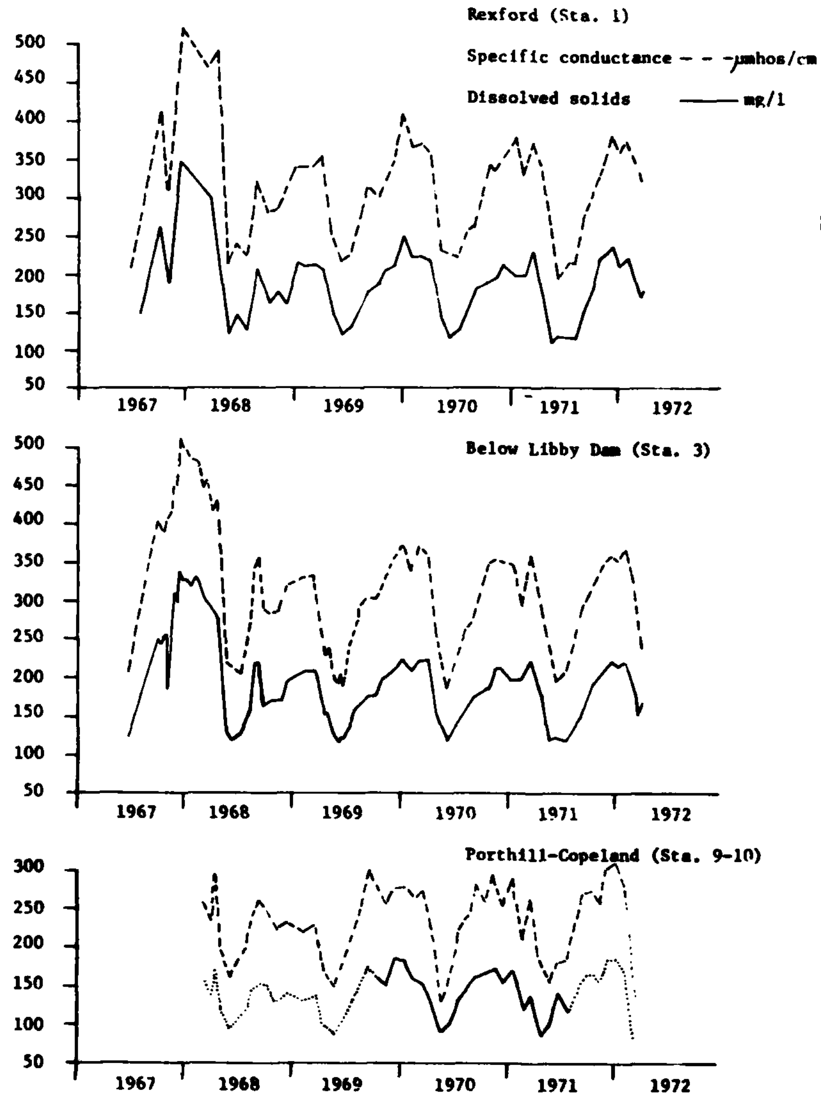


Figure 19. Specific conductance and dissolved solids concentrations in the Kootenai River, 1967-1972.

4.1.11 Carbon Dioxide (CO_2).

Field pH and alkalinity determinations were used to estimate the amount of free CO_2 in solution. Although the calculations show the river as having a relatively wide range of from 0.4 to 105.6 mg/l free CO_2, most determinations were under 4 mg/l. The values obtained are summarized below:

Location	Period	n	mg/l CO_2 Maximum	Minimum	Mean
Sta. 1	Oct 69 - Mar 72	27	20.3	0.5	3.8
Sta. 3	Oct 69 - Mar 72	28	16.0	0.4	3.4
Sta. 9-10	Mar 68 - Sep 69	17	6.3	0.8	2.4
	Oct 69 - Mar 72	80	105.6	0.5	10.0

High CO_2 concentrations appeared to occur more frequently during the fall and winter months than during the rest of the year and more frequently at the downstream stations than those upstream.

4.1.12 Total Dissolved Solids - Specific Conductance.

Determinations of specific conductance and the amount of total dissolved solids, or to be more precise the filterable residue, in the water were made at a number of the sampling stations on the Kootenai River. A summary of the results from three of these stations is presented in figure 19 and tabulated below:

Location	Period	n	mg/l total dissolved solids (Specific Conductance µmhos/cm 25°C) Maximum	Minimum	Mean
Sta. 1	June 67 - Sep 69	24	349	122	193
		24	(522)	(216)	(315)
	Oct 69 - Mar 72	30	252	112	184
		27	(411)	(195)	(327)
Sta. 3	Jun 67 - Sep 69	16	338	122	190
		16	(511)	(199)	(304)
	Oct 69 - Mar 72	32	226	118	182
		31	(372)	(190)	(302)
Sta. 9-10	Mar 68 - Sep 69	16 1/	179	91	136
		16	(300)	(150)	(224)
	Oct 69 - Mar 72	30 1/	189	83	147
		30	(311)	(129)	(242)

The concentration of total dissolved solids ranged from a maximum of 349 mg/l at station 1 in December 1967 to a minimum of 83 mg/l for station 9 in March 1972. The total dissolved solids data indicate downstream dilution as the river traverses the United States. Specific conductance, as might be expected, follows practically the same pattern in the Kootenai River as seen in dissolved solids. Values range from 522 µmhos at station 1 to 129 µmhos at station 9.

1/Estimates based partially or wholly on conductance values.

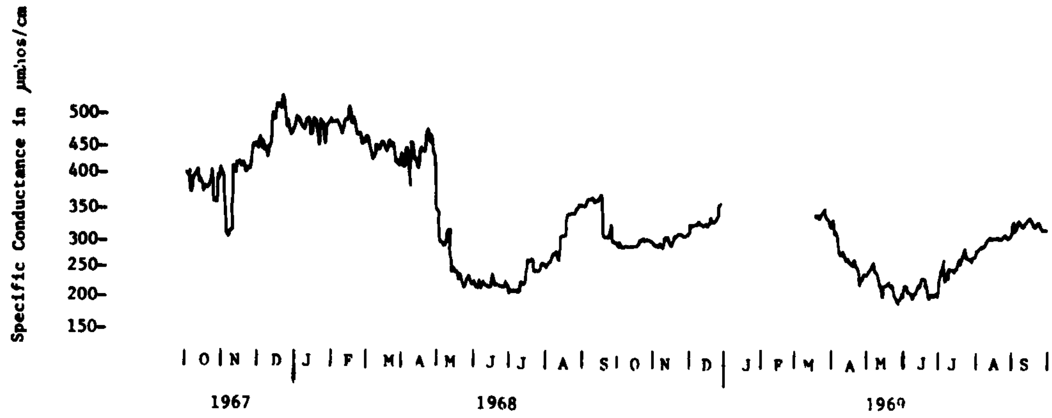


Figure 20. Specific conductance for the Kootenai River below Libby Dam, 1967-1972.

Figure 19 indicates that conductance and dissolved solids concentrations were significantly higher in the winter of 1967-68 than during the remaining years of study. Daily determinations of specific conductance at station 3 for the period October 1967 through September 1969 are contained in the appendix, table 35. A graph of that information (figure 20) indicates not only the high conductance values which characterized the winter of 1967-68, but also a rather abrupt decrease which occurred between the 17th and 18th of September 1968 when the conductance dropped from 356 µmhos to 287 µmhos.

The abnormally high conductivity values observed from the beginning of the study through September 1968 can be attributed to industrial waste discharges in Canada and the decline attributed to efforts to control the wastes discharged to the river system. Since October 1968, total dissolved solids concentrations and conductance values have remained relatively stable, apparently fluctuating only with variations in discharge.

4.1.13 Hardness.

The water of the Kootenai River is moderately hard to hard. Total hardness concentrations, reported as $CaCO_3$, ranged from 273 mg/l at station 1 in December 1967 to 64 mg/l at station 9 in May 1970. A summary of the data for three of the stations sampled is shown below:

Location	Period	n	mg/l Total Hardness Maximum	Minimum	Mean
Sta. 1	Jun 67 - Sep 69	24	273	103	157
	Oct 69 - Mar 72	30	194	91	150
Sta. 3	Jun 67 - Sep 69	16	263	101	152
	Oct 69 - Mar 72	30	184	82	148
Sta. 9	Apr 68 - Sep 69	15	256	80	131
	Oct 69 - Mar 72	25	152	64	121

Total hardness follows the same general trends established for total dissolved solids. Peak concentration, which exceeded 250 mg/l over the winter of 1967-68, declined and fluctuated throughout the remainder of the preimpoundment period around a mean of from 120 to 150 mg/l.

Noncarbonate hardness, which reached 137 mg/l at station 1 in December 1967, did not exceed 50 mg/l at any of the stations after October 1968 and was noted to reach zero at some of the downstream stations during the latter part of the study.

4.1.14 Calcium (Ca).

Calcium is among the most common of the substances in water and is usually more abundant than any of the other alkaline-earth metals. As is magnesium, Ca is essential to plant growth and is among the least toxic cations in the aquatic environment. Calcium was found to be the dominant cation in the Kootenai River. Calcium concentrations ranged from a maximum of 85 mg/l at station 1 in December 1967 to 18 mg/l at station 9 in March 1972. A summary of the data for three of the stations sampled is shown below:

Location	Period	n	mg/l Ca Maximum	mg/l Ca Minimum	mg/l Ca Mean
Sta. 1	Jun 67 - Sep 69	24	85	31	45
	Oct 69 - Mar 72	30	51	26	41
Sta. 3	Jun 67 - Sep 69	16	81	30	44
	Oct 69 - Mar 72	30	50	23	40
Sta. 9-10	Oct 69 - Mar 72	19	41	18	32

Mean Ca concentrations ranged from 40 to 45 mg/l as the river entered the United States to about 30 mg/l as it left the country.

Calcium concentrations obtained during the course of the study are graphed in figure 21. It is significant to note here that the trend for Ca, as did that for total hardness, parallels that previously noted for total dissolved solids.

4.1.15 Magnesium (Mg).

Magnesium concentrations ranged from 16 mg/l at stations 1 and 3 in January 1970 to 4.6 mg/l at station 9 in May 1971. A summary of the data for three of the stations sampled is shown below:

Location	Period	n	mg/l Mg Maximum	mg/l Mg Minimum	mg/l Mg Mean
Sta. 1	Jun 67 - Sep 69	24	15	6.3	11
	Oct 69 - Mar 72	30	16	6.3	12
Sta. 3	Jun 67 - Sep 69	16	15	6.3	10
	Oct 69 - Mar 72	30	16	6.0	12
Sta. 9-10	Oct 69 - Mar 72	19	12	4.6	9.3

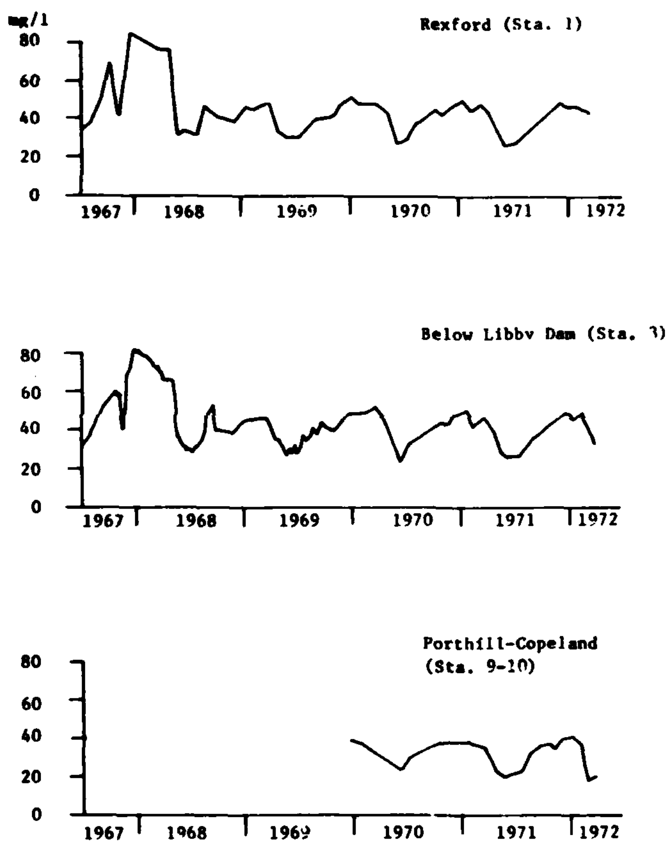


Figure 21. Calcium concentrations in the Kootenai River, 1967-1972.

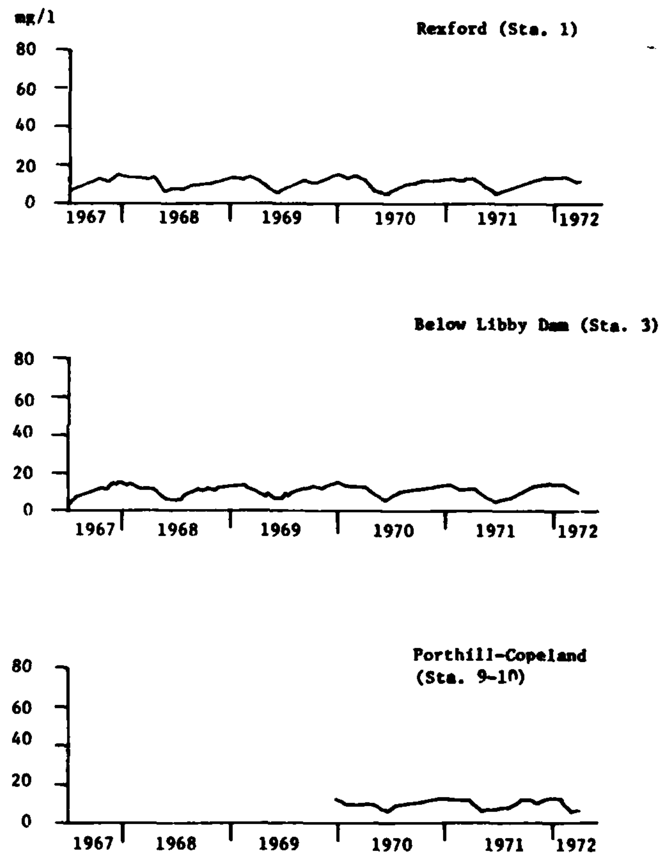


Figure 22. Magnesium concentrations in the Kootenai River, 1967-1972.

Magnesium concentrations averaged about 12 mg/l as the river entered the United States, diluting downstream to 9 mg/l as the river re-entered Canada. A graph of Mg concentrations is shown in figure 22. An interesting feature of Mg is that concentrations remained relatively stable throughout the study period, apparently lacking the high concentrations which characterized some of the other parameters such as Ca.

4.1.16 Sodium (Na).

Sodium concentrations ranged from 6.9 mg/l at station 3 in November 1970 to 0.8 mg/l at station 3 in June 1971. A summary of the data for three of the stations sampled is shown below:

Location	Period	n	mg/l Na Maximum	Minimum	Mean
Sta. 1	Jun 67 - Sep 69	24	4.2	1.1	2.7
	Oct 69 - Mar 72	30	6.3	1.1	4.0
Sta. 3	Jun 67 - Sep 69	16	3.8	1.0	2.6
	Oct 69 - Mar 72	30	6.9	0.8	4.0
Sta. 9-10	Apr 68 - Sep 69	15	3.6	1.0	2.3
	Oct 69 - Mar 72	14	4.6	1.5	3.2

Sodium concentrations, which averaged 2.7 mg/l at station 1 during the earlier phase of the study, increased to 4.0 mg/l in the later phase. Figure 23 shows this increase being reflected throughout the system. Highest concentrations appeared during the winters of 1969-70 and 1970-71.

4.1.17 Potassium (K).

Potassium concentrations ranged from 2.8 mg/l at station 3 in December 1971 to 0.2 mg/l at station 1 in June 1971. A summary of the data for three of the stations is shown below:

Location	Period	n	mg/l K Maximum	Minimum	Mean
Sta. 1	Jun 67 - Sep 69	24	1.2	0.4	0.8
	Oct 69 - Mar 72	30	1.4	0.2	0.8
Sta. 3	Jun 67 - Sep 69	16	2.0	0.5	1.0
	Oct 69 - Mar 72	30	2.8	0.4	0.9
Sta. 9-10	Mar 67 - Sep 69	16	1.0	0.5	0.8
	Oct 69 - Mar 72	20	1.6	0.3	0.9

Mean K concentration ranged from 0.8 to 1.0 mg/l at the various stations sampled. The apparent stability of K ion concentrations is shown in figure 24. Unlike many of the other chemical parameters, K did not appear to follow any seasonal or long-term trends and concentrations entering the United States are roughly the same as concentrations leaving the United States.

4.1.18 Sulfate (SO_4).

Sulfate concentrations in the Kootenai River ranged from 138 mg/l to 11 mg/l. A summary of the data for three of the stations sampled is shown below:

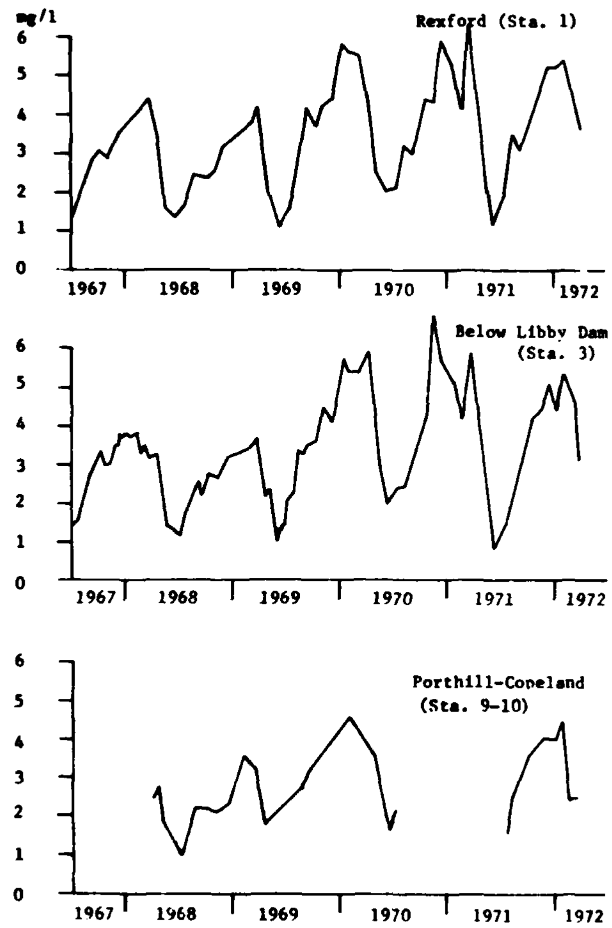


Figure 23. Sodium concentrations in the Kootenai River, 1967-1972.

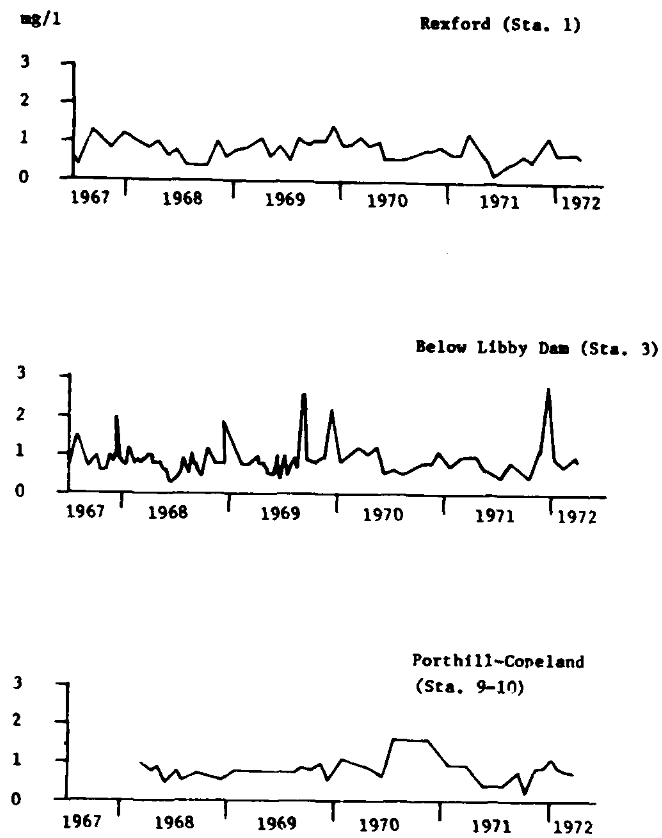


Figure 24. Potassium concentrations in the Kootenai River, 1967-1972.

Location	Period	n	mg/1 SO_4 Maximum	Minimum	Mean
Sta. 1	Jun 67 - Sep 69	24	138	12	49
	Oct 69 - Mar 72	30	51	12	36
Sta. 3	Jun 67 - Sep 69	16	133	12	36
	Oct 69 - Mar 72	30	51	11	34
Sta. 9-10	Apr 68 - Sep 69	15	58	14	30
	Oct 69 - Mar 72	18	53	13	27

A graph of the SO_4 concentrations is shown in figure 25. Sulfate is one of the major anions in freshwater and the second most abundant anion in the Kootenai River, exceeded in quantity only by bicarbonates. Unlike bicarbonates, however, which have remained rather stable, SO_4 concentrations have undergone fluctuations similar to those experienced by the major cation Ca. Following the peaks in SO_4 concentration experienced early in the study, concentrations have varied between 11 and 53 mg/1 with little difference in range among sampling stations, although the mean for downstream stations was less than that for upstream stations. A summary of SO_4 for the upstream and downstream stations on the Kootenai River in the United States is presented below:

Location	Period	n	SO_4 Loading, Metric Tons/Day Maximum	Minimum	Mean
Sta. 1	Jun 67 - Dec 67	6	2,200	379	1,163
	1968 Calendar year	9	2,384	378	1,159
	1969 Calendar year	12	1,683	307	666
	1970 Calendar year	12	1,249	146	509
	1971 Calendar year	12	1,853	257	649
Sta. 9-10	Mar 68 - Dec 68	10	3,793	492	1,368
	1969 Calendar year	6	2,799	295	976
	1970 Calendar year	6	1,117	408	612
	1971 Calendar year	9	874	256	470

An approximate 50 percent decrease in mean daily SO_4 loading in the river occurred after 1968.

4.1.19 Chloride (Cl).

Chloride concentrations ranged from 7.1 mg/1 at station 1 in December 1971 to less than 1.0 mg/1 at station 10 on a number of occasions during 1968 and 1969. A summary of these data for three of the stations sampled is shown below:

Location	Period	n	mg/1 Cl Maximum	Minimum	Mean
Sta. 1	Jun 67 - Sep 69	24	3.0	0.4	1.8
	Oct 69 - Mar 72	30	7.1	1.1	2.7
Sta. 3	Jun 67 - Sep 69	16	2.8	0.8	1.8
	Oct 69 - Mar 72	29	6.0	1.0	3.5
Sta. 9-10	Apr 68 - Sep 69	15	3.0	1.0	1.7
	Oct 69 - Mar 72	23	4.5	1.4	3.1

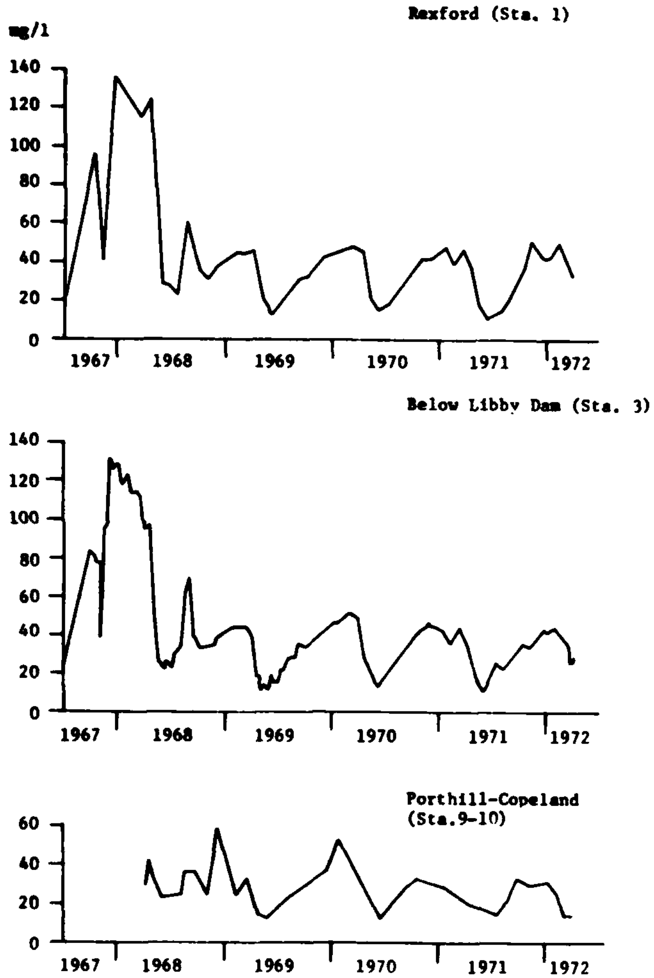


Figure 25. Sulfate concentrations in the Kootenai River, 1967-1972.

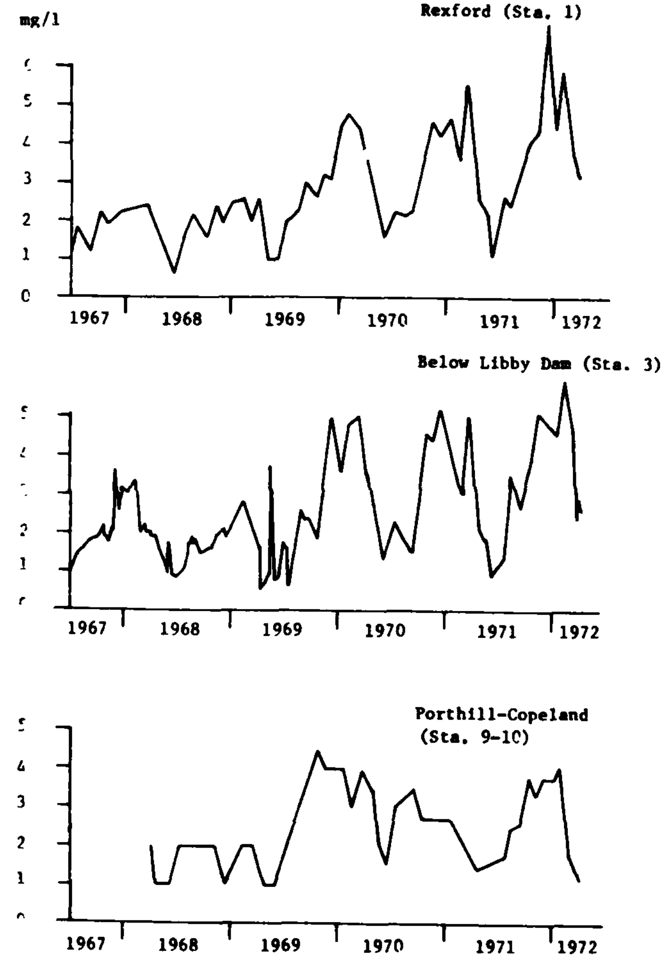


Figure 26. Chloride concentrations in the Kootenai River, 1967-1972.

Mean Cl concentrations at station 1 increased from 1.8 mg/l during the early phase of the study to 2.7 mg/l during the later phase, with the downstream stations reflecting increases of similar magnitude. A graph of the Cl data is shown in figure 26. The temporal increases noted in Cl ions parallel, in many respects, increases noted in the Na ion.

4.1.20 Fluoride (F).

Fluoride concentrations in the river were high, with mean concentrations of 0.6 - 0.8 mg/l. Lower concentrations characterized downstream stations, indicating dilution as the river flowed through the United States. A graph of F concentrations for stations 1, 3, and 9-10 is presented in figure 27. A summary of the data for these stations is shown below:

Location	Period	n	mg/l F Maximum	Minimum	Mean
Sta. 1	Jun 67 - Sep 69	24	3.4	0.0	0.9
	Oct 69 - Mar 72	30	1.6	0.1	0.8
Sta. 3	Jun 67 - Sep 69	16	2.0	0.2	0.7
	Oct 69 - Mar 72	30	1.5	0.2	0.7
Sta. 9-10	Mar 67 - Sep 69	—	—	—	—
	Oct 69 - Mar 72	13	1.1	0.2	0.6

As can be seen in figure 27, there was a decline in observed peak F concentrations after mid-1968. The decline in F in the river is also reflected in the loading data, tables 47-49 of the appendix. For example, the mean F loading at station 1 for June 1967-December 1968 is 21.4 metric tons/day and for January 1969-March 1972 it is calculated to be 11 metric tons/day.

4.1.21 Silica (SiO_2).

Silica concentrations observed range from 10 mg/l at station 10 in April 1969 to 0.8 mg/l at station 3 in August 1970. Silica concentrations monitored at stations 1, 3, and 9-10 are graphed in figure 28 and a summary of the data for these stations is presented below:

Location	Period	n	mg/l SiO_2 Maximum	Minimum	Mean
Sta. 1	Jun 67 - Sep 69	24	8.5	4.1	5.9
	Oct 69 - Mar 72	30	7.7	1.3	5.7
Sta. 3	Jun 67 - Sep 69	16	8.3	2.8	6.0
	Oct 69 - Mar 72	30	8.9	0.8	5.8
Sta. 9-10	Mar 68 - Sep 69	16	10.0	3.2	6.9

The mean SiO_2 concentrations for these three stations ranged from 5.8 to 6.9 mg/l with the higher value characterizing the downstream stations. While SiO_2 concentrations appear to demonstrate some of the trends characteristic of parameters such as Ca, the decline appeared to be more gradual, occurring over a period of years and culminating in the low concentrations noted in the summer of 1970.

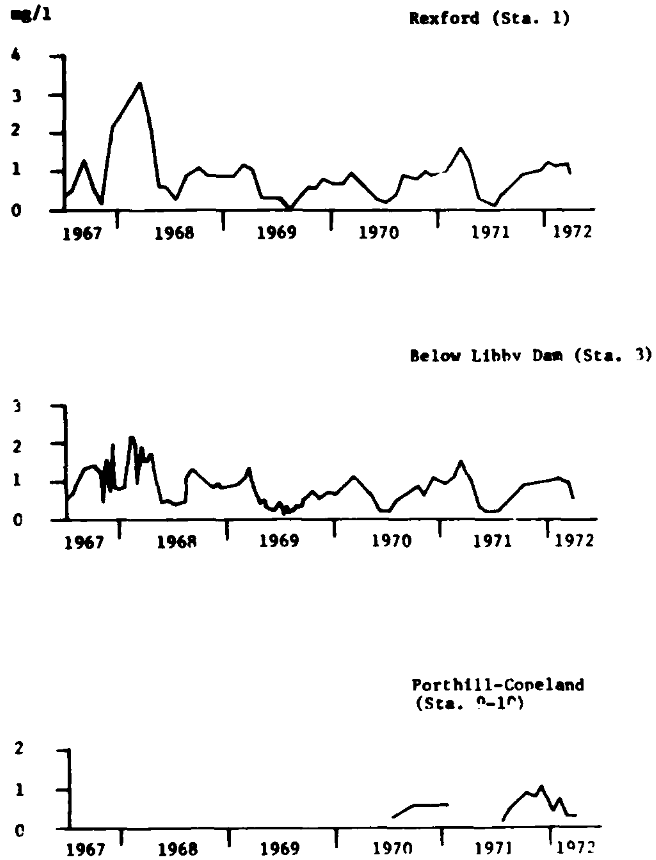


Figure 27. Fluoride concentrations in the Kootenai River, 1967-1972.

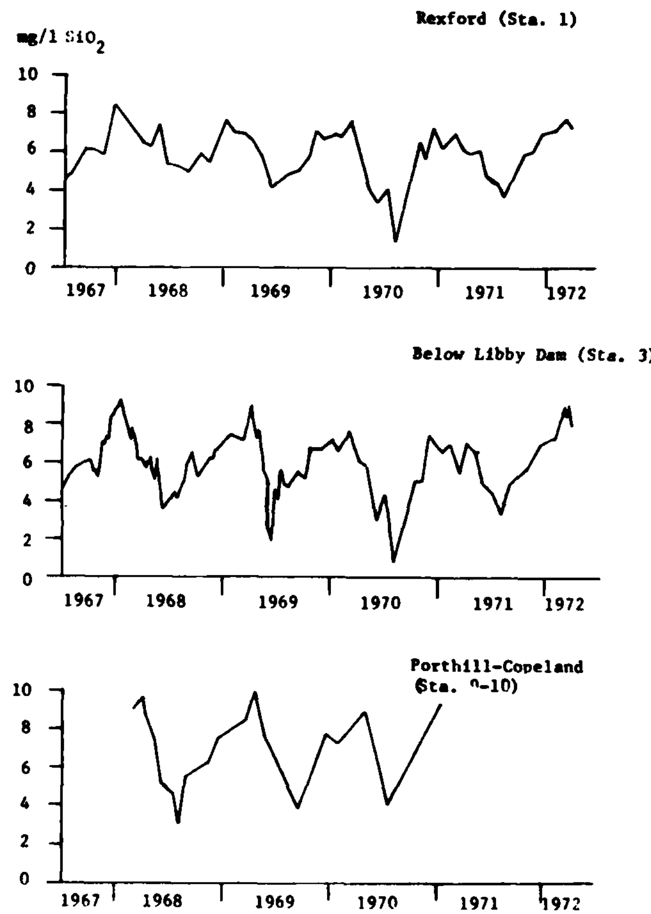


Figure 28. Silica concentrations in the Kootenai River, 1967-1972.

4.1.22 Phosphorus.

A plot of total and ortho P concentrations for the study period for stations 1, 3, and 9-10 is presented in figure 29 and a summary of P data is presented below:

Location	Period	n	mg/l Ortho-P Maximum	Minimum	Mean
Sta. 1	Oct 67 - Dec 67	3	0.92	0.07	0.52
	1968	10	0.97	0.14	0.42
	1969	10	0.26	0.01	0.08
	1970	12	0.35	0.04	0.12
	1971	12	0.17	0.01	0.06
	Jan 72 - Mar 72	3	0.15	0.06	0.11
Sta. 3	Oct 67 - Dec 67	4	0.53	0.08	0.37
	1968	9	1.08	0.11	0.48
	1969	10	0.23	0.01	0.11
	1970	12	0.37	0.01	0.12
	1971	12	0.16	0.00	0.07
	Jan 72 - Mar 72	5	0.13	0.01	0.08
Sta. 9-10	Mar 68 - Dec 68	11	0.25	0.05	0.15
	1969	6	0.18	0.022	0.06
	1970	6	0.13	0.06	0.10
	1971	12	0.10	0.00	0.05
	Jan 72 - Mar 72	3	0.13	0.02	0.07

Location	Period	n	mg/l Total dissolved P Maximum	Minimum	Mean
Sta. 1	Oct 67 - Dec 67	3	0.94	0.09	0.55
	1968	9	1.09	0.17	0.49
	1969	10	0.34	0.03	0.16
	1970	9	0.15	0.04	0.09
Sta. 3	Oct 67 - Dec 67	4	0.72	0.09	0.55
	1968	8	1.20	0.15	0.52
	1969	10	0.49	0.02	0.15
	1970	9	0.18	0.04	0.10
Sta. 9-10	1969	6	0.18	0.00	0.09
	1970	12	0.17	0.01	0.07
	1971	12	0.13	0.00	0.07
	Jan 72 - Mar 72	3	0.14	0.05	0.09

Location	Period	n	mg/l Total P Maximum	Minimum	Mean
Sta. 1	Oct 69 - Dec 69	3	0.33	0.14	0.21
	1970	12	0.41	0.05	0.21
	1971	10	0.31	0.04	0.18
	Jan 72 - Mar 72	3	0.22	0.16	0.19
Sta. 3	Oct 69 - Dec 69	3	0.55	0.19	0.34
	1970	12	0.43	0.08	0.20
	1971	11	0.27	0.04	0.16
	Jan 72 - Mar 72	5	0.18	0.11	0.14
Sta. 9-10	Mar 68 - Dec 68	11	0.33	0.072	0.20
	1969	9	0.18	0.01	0.09
	1970	12	0.20	0.02	0.09
	1971	11	1.10	0.05	0.19
	Jan 72 - Mar 72	3	0.15	0.11	0.13

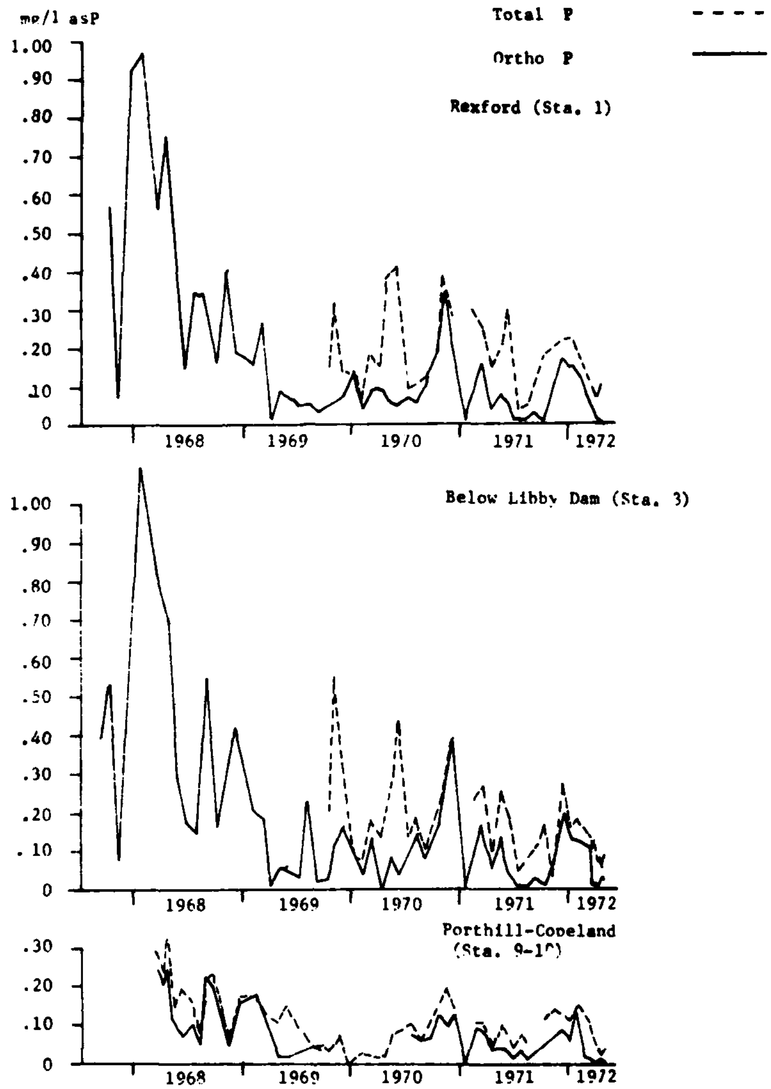


Figure 29. Total and ortho-phosphorus concentrations in the Kootenai River, 1967-1972.

As shown in figure 29 and reflected in the above table, there was a significant reduction in P levels in the river after 1968. Ortho-P concentrations in 1968 reached as high as 0.97 mg/l at station 1 and 1.08 mg/l at station 3. After 1968, peak ortho-P concentrations were 0.35 and 0.37 mg/l for stations 1 and 3, respectively. The mean ortho-P concentration decreased from 0.44, 0.45, and 0.15 mg/l at stations 1, 3, and 9-10, respectively in 1967-1968, to 0.09, 0.10, and 0.07 mg/l, respectively, after 1968.

Lower mean ortho and total dissolved P concentrations were more characteristic of the downstream stations in the Kootenai River than upstream stations.

Phosphorus loading in the Kootenai River for the days sampled are presented in the appendix (tables 47, 48, and 49) and summarized below:

Location	Period	n	Ortho P Loading metric tons/day Maximum	Minimum	Mean
Sta. 1	1968	10	33.2	1.9	9.2
	1969	10	4.0	0.1	1.4
	1970	12	3.9	0.2	1.7
	1971	12	9.2	0.1	1.7
Sta. 3	1968	9	29.1	3.2	10.2
	1969	10	6.5	0.2	1.8
	1970	12	4.4	0.1	2.0
	1971	12	9.6	0.0	1.8
Sta. 9-10	Mar 68 - Dec 68	11	2.9	0.6	1.8
	1969	6	4.0	0.6	1.8
	1970	6	3.0	1.0	1.5
	1971	12	5.6	0.0	1.5

Location	Period	n	Total P Loading Metric Tons/Day Maximum	Minimum	Mean
Sta. 1	1970	12	32.0	0.3	5.5
	1971	10	46.3	1.3	7.5
Sta. 3	1970	12	42.8	0.5	5.9
	1971	11	28.4	0.4	5.8
Sta. 9-10	Mar 68 - Dec 68	11	6.3	1.6	3.2
	1969	9	30.0	0.1	5.2
	1970	12	7.7	0.1	2.4
	1971	11	16.0	1.2	4.7

The sharp reduction in P level in the Kootenai River after 1968 is demonstrated by the ortho-P loading data. Mean ortho-P loading at stations 1 and 3 decreased from 9.2 and 10.2 metric tons/day, respectively, in 1968, to 1.4-1.7 and 1.8-2.0 metric tons/day, respectively, in 1969, 1970 and 1971. Such a dramatic reduction was not as evident at stations 9-10.

A reduction in the average daily amount of P being carried by the river in its flow through the United States is indicated by the loading data.

Annual P loading was estimated by summation of computed daily loading which is calculated using mean daily discharge and estimated daily P concentrations as computed from linear interpolation of observed data. Estimated annual loadings for stations 1 and 3 are presented below:

Metric Tons Total P/Year

		Sta. 1	Sta. 3
1970	calendar year	1,827	1,905
1971	calendar year	—	1,924

Metric Tons Ortho-P/Year

		Sta. 1	Sta. 3
1968	calendar year	3,225	3,259
1969	calendar year	840	816
1970	calendar year	595	688
1971	calendar year	—	705

The sharp decrease after 1968 of P being carried by the river as it enters the United States is shown by the data. After 1968, loading remained rather stable. In the order of 2,000 metric tons per year total P, about 35 percent being ortho-P, is expected to enter Lake Koocanusa annually upon impoundment of the river if loading remains consistent with that estimated for 1969, 1970, and 1971.

4.1.23 Nitrogen (N).

The four forms of N sampled during the study were ammonia (NH_3-N), nitrite (NO_2-N), nitrate (NO_3-N), and organic N which, in sum, provide an estimate of the total N present in the water.

Nitrites are unstable in the presence of dissolved oxygen and are quickly oxidized to NO_3. As would be expected, NO_2-N was generally found to be below detectable limits in the highly oxygenated waters of the Kootenai River and on the average represented 2 percent of the total N.

Ammonia Nitrogen (NH_3-N)

Ammonia nitrogen concentrations ranged from 0.93 mg/l (station 8, March 1971) to undetectable levels, with undetectable levels occurring rather frequently at stations throughout the river system. A summary of NH_3-N concentrations at three of the sampling stations is presented below:

Location	Period	n	mg/l NH_3-N Maximum	Minimum	Mean
Sta. 1	Oct 69 - Mar 72	30	.37	.00	.11
Sta. 3	Oct 69 - Mar 72	30	.36	.00	.08
Sta. 9-10	Mar 68 - Sep 69	16	.12	.01	.05
	Oct 69 - Mar 72	30	.21	.00	.07

Ammonia concentrations have been graphed in figure 30; no long-term trends are indicated.

Nitrate Nitrogen (NO_3-N).

Nitrate nitrogen concentrations ranged from 2.0 mg/l at station 8 in March 1972 to below detectable limits. Concentrations observed at three of the stations sampled are graphed in figure 30 and summarized below:

Location	Period	n	mg/l NO_3-N Maximum	Minimum	Mean
Sta. 1	Oct 69 - Mar 72	30	.28	.00	.14
Sta. 3	Oct 69 - Mar 72	30	.79	.00	.16
Sta. 9-10	Mar 68 - Sep 69	17	.25	.01	.09
	Oct 69 - Mar 72	30	.44	.00	.09

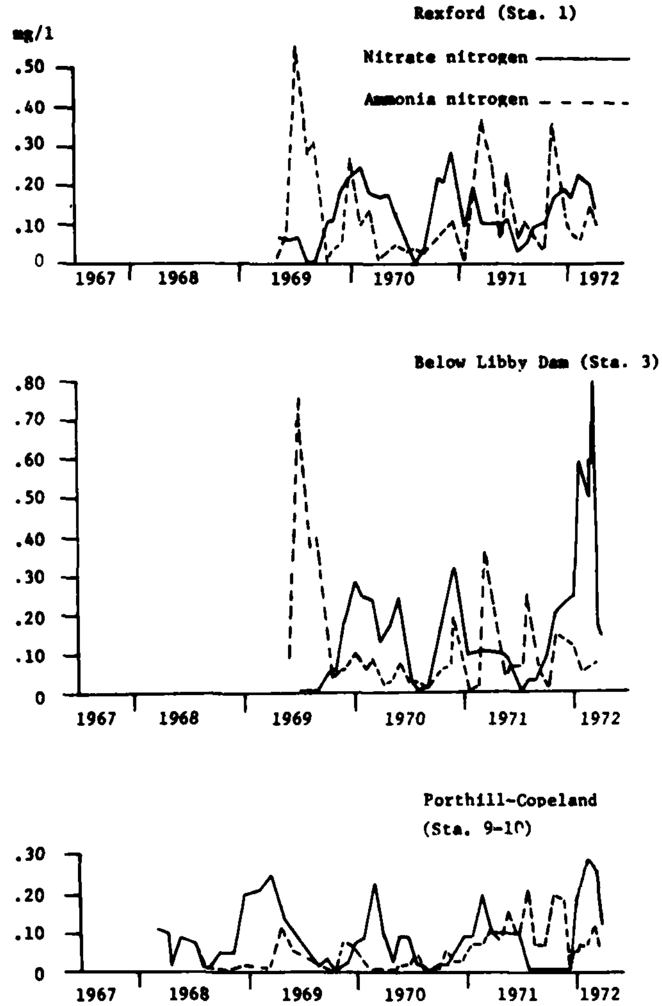


Figure 30. Ammonia nitrogen and nitrate nitrogen concentrations in the Kootenai River, 1967-1972.

A decrease in NO_3-N concentration as the river flows through the United States is indicated by the data. Seasonal trends which occurred at all stations differ somewhat from the parameters previously discussed in that minimum concentrations occur in late summer and early fall, rather than during the usual April to June period of peak stream-flow.

<u>Organic Nitrogen.</u>

Concentration of organic N ranged from 2.9 mg/l at station 9 in January 1972 to below detectable limits on a number of occasions, mostly in 1970 and 1971. A summary of the determinations made at three of the sampling stations is shown below:

Location	Period	n	mg/1 Organic N Maximum	Minimum	Mean
Sta. 1	Oct 69 - Mar 72	30	0.41	0.00	0.13
Sta. 3	Oct 69 - Mar 72	30	0.31	0.00	0.14
Sta. 9-10	Mar 68 - Sep 69	16	0.69	< 0.04	< 0.28
	Oct 69 - Mar 72	28	0.40	0.00	0.09

Mean organic N concentrations for the period October 1969 through March 1972 were 0.13 mg/l at station 1, 0.14 mg/l at station 3, and 0.09 mg/l at stations 9-10.

Total Nitrogen.

Estimated total N concentration (the sum of the organic and inorganic components) is graphed in figure 31. In general, concentrations of both organic and inorganic N are higher in the upstream areas than downstream. On the average, organic N, NO_3-N, NO_2-N, and NH_3-N at station 1 was 34, 38, 2, and 26 percent of total N, respectively. At stations 9-10 the mean percent of total N that was organic increased to 39 percent, while the percent that was NO_3-N and NH_3-N decreased to 36 and 23 percent, respectively. There is indication that N concentrations at station 9 increased following the particularly low concentration of 1970 and early 1971.

Total N loading for the days sampled is presented in tables 47, 48, and 49 of the appendix and summarized below:

Location	Period	n	Total N Loading (metric tons/day) Maximum	Minimum	Mean
Sta. 1	1970	12	27.3	1.1	7.1
	1971	12	55.6	0.6	11.2
Sta. 3	1970	12	50.8	1.0	8.5
	1971	12	52.5	0.6	11.1
Sta. 9-10	1969	9	45.9	1.0	13.1
	1970	12	16.8	0.4	4.2
	1971	10	68.1	1.4	17.1

Low runoff and relatively low N concentrations characterized the Kootenai River in 1970 and may explain the low N loading values in 1970. The large discrepancy between 1970 and 1971 N loading at stations 9-10 may be the result of delay in transport of N downstream due to the differences in discharge between 1970 and 1971.

An estimate of annual N loading in the river at stations 1 and 3 is presented below:

Period	Total N Loading Metric tons N/annum Station 1	Station 3
1970	2,376	2,825
1971	4,070	4,057

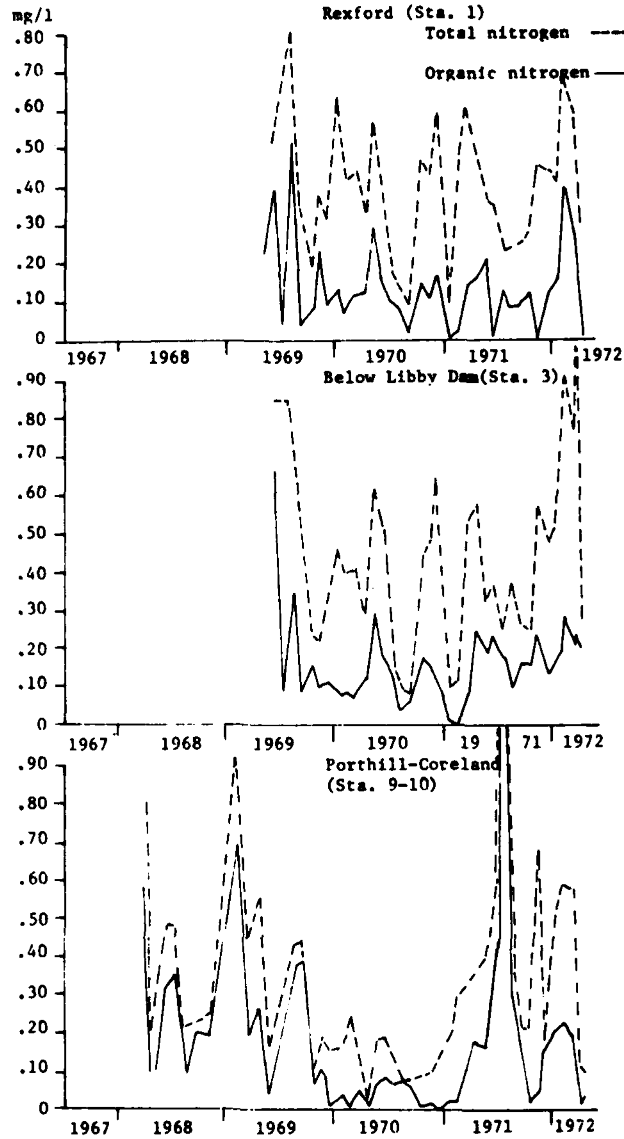


Figure 31. Total and organic nitrogen concentrations in the Kootenai River 1967-1972.

The annual loading was estimated by summing computed daily loadings which were calculated from mean daily discharges and estimated daily N concentrations as computed from linear interpolation of observed concentration data.

If stream loadings of N were to remain consistent with those recorded for 1969-71, an estimated N load'ng in excess of 3000 metric tons/year would be expected to enter Lake Koocanusa following impoundment of the Kootenai River by Libby Dam.

4.1.24 Trace Elements.

Fresh waters contain a number of elements which under normal conditions are found in extremely small quantities, usually less than a milligram per liter. Many of the trace elements are essential for biological functions of aquatic organisms, although some of these same essential elements are toxic to life if present in appreciable quantities.

Among the trace elements monitored in the Kootenai River were Fe, Mn, Cu, Pb, Zn, Mo, Co, B, V, Al, Li, Se, Ba, Ni, Ag, Be, Sr, Cd, As, Hg, and Cr.

Iron (Fe).

Among the trace elements monitored that are essential for the operation of living systems is Fe. Concentrations of dissolved Fe ranged from a maximum of 240 µg/l to undetectable levels during the period of study. A summary of Fe data for three of the stations sampled is shown below:

			Dissolved Fe µg/l (Kg Fe/day)		
Location	Period	n	Maximum	Minimum	Mean
Sta. 1	Oct 69 - Mar 72	30	240	0	63
	Oct 69 - Mar 72	30	(7,840)	(0)	(1,192)
Sta. 3	Oct 69 - Mar 72	30	160	0	52
	Oct 69 - Mar 72	30	(8,516)	(0)	(1,114)
Sta. 9-10	Nov 69 - Mar 72	18	200	10	41
	Nov 69 - Mar 72	18	(9,935)	(136)	(1,320)

Although the mean concentrations of dissolved iron in the river declined from 63 ug/l at station 1 to 41 ug/l at station 9 during the period extending from October 1969 through March 1972, a small increase (about 11 percent) in the mean daily loading between station 1 and stations 9-10 was observed.

Monitoring of total Fe during the last year of study indicated that the greater part of the Fe present in the river was in suspended or particulate form. A graph of Fe concentrations is shown in figure 32. No particular trend, other than that which might be attributed to downstream dilution, is apparent in the data.

Manganese (Mn).

Manganese is essential to all organisms and plays a role in algal nitrogen metabolism and photosynthesis. Manganese concentrations ranged from 430 µg/l at station 1 to below detectable limits during the period from October 1969 through March 1972. A summary of the data for three of the locations sampled is shown below:

			µg/l Mn		
Location	Period	n	Maximum	Minimum	Mean
Sta. 1	Oct 69 - Mar 72	30	430	0	46
Sta. 3	Oct 69 - Mar 72	29	250	0	34
Sta. 9-10	Nov 69 - Jun 71	10	390	0	55

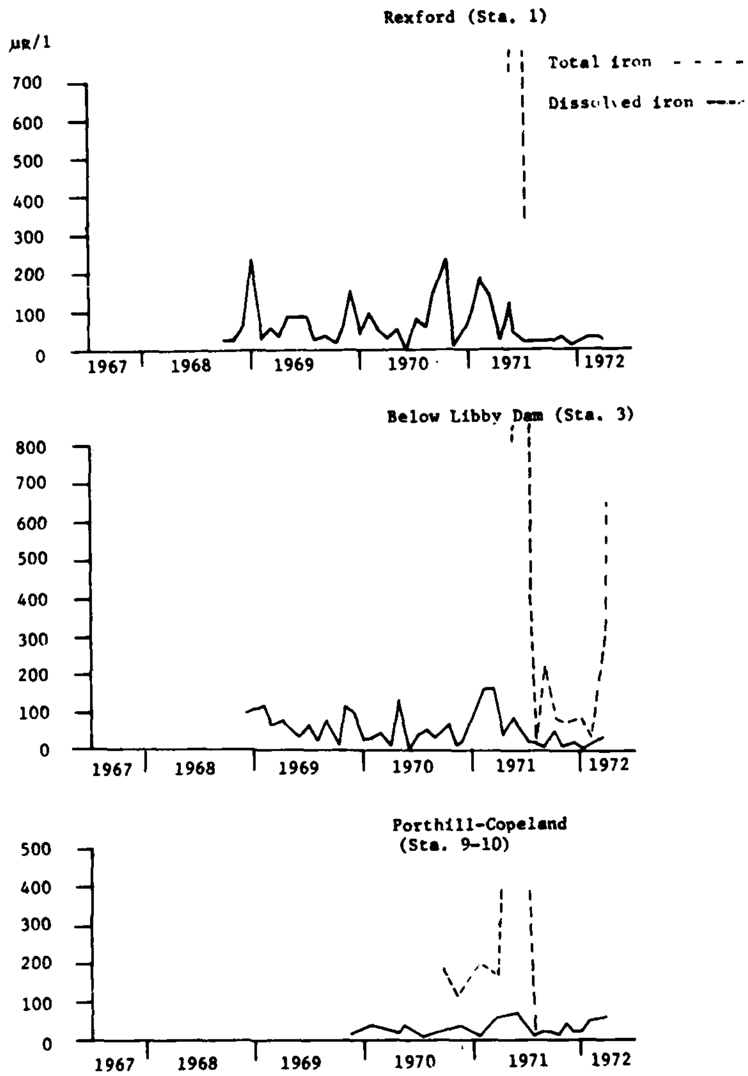


Figure 32. Iron concentrations in the Kootenai River, 1967-1972.

Mean concentrations were 46 μg/1 at station 1, 34 μg/1 at station 3, and 55 μg/1 at station 9. A graph of the Mn data is presented in figure 33. Mn concentrations remained low except for a single analysis at stations 1 and 3 in February and Station 9 in March 1971.

Total Mn was sampled during the last year of the study. Anomalies occasionally appeared in analysis of total Mn which indicated levels lower than dissolved Mn.

Copper (Cu).

Although Cu is required by all organisms, any appreciable amount in the water may be lethal to fish and other aquatic life. For example, levels of 20 μg/1 Cu have been reported to be toxic to fish and, under

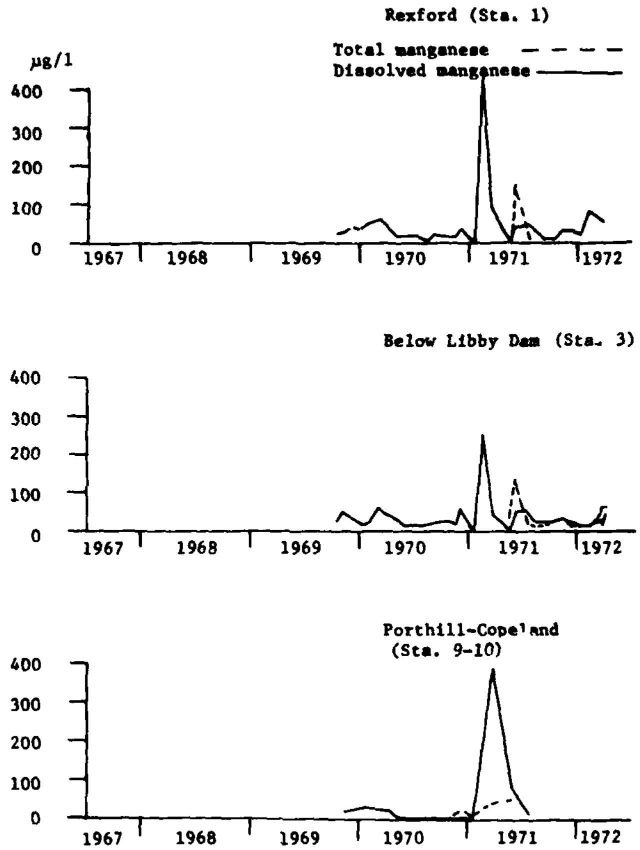


Figure 33. Manganese concentrations in the Kootenai River, 1967-1972.

some conditions, 10 µg/l have been found to be lethal to some aquatic organisms (Buhler, 1973). Cu concentrations in the Kootenai River ranged from below the detectable limit up to 30 µg/l. A summary of the data is shown below:

Location	Period	n	Dissolved Cu µg/l		
			Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	6	0	1
Sta. 3	Oct 70 - Mar 72	18	17	0	2
Sta. 9	Oct 69 - Sep 70	5	30	4	10
	Oct 70 - Mar 72	13	2	0	1

With the exception of determinations of 30 µg/l at stations 9-10 in November 1969 and 17 ug/l at station 3 in October 1970, dissolved Cu concentrations did not exceed 8 µg/l and only rarely exceeded 2 µg/l during the last year and one-half of the study. Determinations of total Cu were infrequent but those that were done showed the river to contain, with one exception, less than 10 µg/l.

Lead (Pb).

Dissolved Pb concentrations in the Kootenai River ranged from below detectable limits up to 23 μg/1, and thereby did not appear to be present in sufficient quantity to be normally lethal to aquatic organisms. Under some conditions, however, the lethal concentration for Pb can be as low as 10 μg/1 (Buhler, 1973). A summary of the data is shown below:

Location	Period	n	μg/1 Dissolved Pb Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	8	0	2
Sta. 3	Oct 70 - Mar 72	18	6	0	1
Sta. 9	Oct 69 - Sep 70	5	23	7	11
	Oct 70 - Mar 72	13	14	0	2

Dissolved Pb concentrations only rarely exceed 10 μg/1. Concentrations of 1-2 μg/1 were characteristic of the river during the last year and one-half of the study. The maximum concentration of total Pb was 60 μg/1 but most total Pb values were under 10 μg/1.

Zinc (Zn).

Zinc is required in minute amounts by algae. As with Cu, however, any appreciable amount in the water is toxic to aquatic life, particularly fish. Concentrations as low as 10 μg/1 have been reported to be toxic to fish, although in general concentrations in excess of 90 μg/1 are reported to be toxic in bioassay studies. Dissolved Zn concentrations ranged from below detectable limits up to 170 μg/1. A summary of the data is shown below:

Location	Period	n	μg/1 Zn Maximum	Maximum	Mean
Sta. 1	Oct 70 - Mar 72	18	78	0	34
Sta. 3	Oct 70 - Mar 72	18	60	0	25
Sta. 9	Oct 69 - Sep 70	5	30	10	14
	Oct 70 - Mar 72	13	170	0	51

Zinc only rarely occurred in concentrations below the detectable limit and was most frequently found within the range of 10 to 80 μg/1. While mean concentrations dropped from 34 μg/1 at station 1 to 25 μg/1 at station 3, occasional high values increased the mean to 51 μg/1 at station 9. Determinations for total Zn were infrequent, but concentrations of total Zn were invariably under 50 μg/1.

Molybdenum (Mo), Cobalt (Co), Boron (B), Vanadium (V)

Dispite being normally present in river water in extremely small quantities, Mo, Co, B, and V play an important role in the biological functions of organisms in the aquatic ecosystem.

Molybdenum is involved in algal nitrate assimilation and the fixation of molecular nitrogen. Concentrations of dissolved Mo in the Kootenai River ranged from 0-12 μg/1 and averaged 1.6 μg/1.

The most pronounced biological importance of Co is that it is a constituent of Vitamin B-12, an organic catalyst required by most aquatic organisms. Cobalt is generally found in fresh waters at concentrations less than 5 µg/l. The maximum concentration of Co found in the Kootenai River was 9 µg/l; the mean was less than 2 µg/l.

Boron is generally found in freshwater in concentrations around 13 µg/l. It is an essential element for the growth of plants and some algae, although its full biological function is not known. Concentrations recorded in the Kootenai River ranged from undetectable to 102 µg/l, with a mean of 13 µg/l.

Vanadium has been reported to be essential to some algae and is a normal constituent of animal and plant matter, although its vital function is not certain. In freshwater, the concentration of V averages 1 µg/l. The average concentration found in the Kootenai River was 0.2 µg/l and the maximum recorded was 1 µg/l.

A summary of the Mo, Co, B, and V data for stations 1, 3, and 9-10 is presented below:

Location	Period	n	Dissolved Mo, µg/l Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	12	0	1.8
Sta. 3	Oct 70 - Mar 72	18	8	0	1.6
Sta. 9-10	Nov 69 - Jul 71	9	3	0	1.2

Location	Period	n	Dissolved Co, µg/l (Co total, µg/l) Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	4	0	0.8
	May 71 - Jul 71	3	(4)	(< 1)	(< 2)
Sta. 3	Oct 70 - Mar 72	18	9	0	1
	May 71 - Mar 72	11	(9)	(0)	(< 2)
Sta. 9-10	Nov 69 - Jul 71	10	3	0	1.5

Location	Period	n	Dissolved B, µg/l (B total, µg/l) Maximum	Minimum	Mean
Sta. 1	Jun 69 - Sep 69	24	60	0	10
	Oct 69 - Mar 72	30	102	0	17
Sta. 3	Jun 69 - Sep 69	16	100	0	14
	Oct 69 - Mar 72	30	41	0	10
Sta. 9-10	Nov 69 - Jul 71	10	20	0	10
	Sep 70 - Mar 71	5	(20)	(< 10)	(< 14)

Location	Period	n	Dissolved V, µg/l Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	1.0	0	0.2
Sta. 3	Oct 70 - Mar 72	18	0.8	0	0.2
Sta. 9-10	Nov 69 - Mar 72	13	2.2	0	0.4

Aluminum (Al), Lithium (Li), Selenium (Se), Nickel (Ni), Silver (Ag), Beryllium (Be), and Cadmium (Cd).

Average concentrations of dissolved Al, Li, Se, Ni, Ag, Be, and Cd found in the waters of the Kootenai River were similar to those reported in the literature for river waters. The mean concentrations for these seven dissolved elements averaged for stations 1, 3, and 9-10 in the Kootenai River were 171, 5.6, 4, 3.2, 0.6, 1.0, and less than 0.3 µg/l, respectively.

A summary of the Al, Li, Se, Ni, Ag, Be, and Cd data for three of the stations sampled is presented below:

Location	Period	n	Dissolved Al, µg/l		
			Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	400	0	156
Sta. 3	Oct 70 - Mar 72	18	400	0	156
Sta. 9-10	Nov 69 - Jul 71	10	600	0	226

Location	Period	n	Dissolved Li, µg/l		
			Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	25	0	5
Sta. 3	Oct 70 - Mar 72	18	22	0	6
Sta. 9-10	Jul 71	1	8	-	8

Location	Period	n	Dissolved Se, µg/l		
			Maximum	Minimum	Mean
Sta. 9-10	Nov 69 - Jan 72	11	13	0	4

Location	Period	n	Dissolved Ni, µg/l		
			Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	15	0	3
Sta. 3	Oct 70 - ar 72	18	4	0	2
Sta. 9-10	Nov 69 - Jul 71	10	10	0	5.5

Location	Period	n	Dissolved Ag, µg/l		
			Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	1	0	0.3
Sta. 3	Oct 70 - Mar 72	18	1	0	0.3
Sta. 9-10	Nov 69 - Jul 71	8	10	0	2.2

Location	Period	n	Dissolved Be, µg/l		
			Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	10	0	1.3
Sta. 3	Oct 70 - Mar 72	18	5	0	0.3
Sta. 9-10	Nov 69 - Jul 71	10	10	0	1.5

Location	Period	n	Dissolved Cd, ug/l (total Cd, µg/l) Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	1	0	0
	May 71 - Jul 71	3	(1)	(<1)	(<1)
Sta. 3	Oct 70 - Mar 72	18	1	0	0
	May 71 - Mar 72	11	(2)	(<1)	(<1)
Sta. 9-10	Nov 69 - Oct 71	11	3	0	1.4
	Sep 70 - Jan 72	4	(3)	(<1)	(<1.5)

Strontium (Sr), Barium (Ba).

Dissolved Sr concentrations observed ranged from 30-360 µg/l, with the average concentration at stations 1 and 3 being about 200 µg/l and the average at station 9 being 138 µg/l. The maximum and mean values for Sr found in the waters of the Kootenai River are somewhat higher than those found in natural streams and lakes. Similarly, concentrations of Ba found in the Kootenai River were higher than those reported for natural lakes and streams. The concentration of Ba in the Kootenai River ranged from undetectable to 1 mg/l and averaged 83, 91, and 161 µg/l at stations 1, 3, and 9, respectively.

A summary of the Sr and Ba concentrations monitored at stations 1, 3, and 9-10 is presented below:

Location	Period	n	Dissolved Sr, µg/l (total Sr, µg/l) Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	300	30	197
Sta. 3	Oct 70 - Mar 72	18	360	40	200
Sta. 9-10	Nov 69 - Jul 71	6	200	80	138
	Nov 70 - May 71	5	(140)	(60)	(98)

Location	Period	n	Dissolved Ba, µg/l Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	320	0	83
Sta. 3	Oct 70 - Mar 72	18	600	0	91
Sta. 9-10	Nov 69 - Jul 71	10	1,000	0	161

Mercury (Hg).

The dissolved Hg level monitored in the Kootenai River was, on the average, slightly in excess of 0.1 µg/l. Excluding the single value of 1.0 µg/l at station 3 on 13 March 1972 and the single high value of 3.1 µg/l at stations 9-10 on 2 March 1972, the mean dissolved Hg for stations 1, 3, and 9-10 were 0.1, 0.1, and 0.3 µg/l, respectively. Only a few determinations of total Hg were made and the level found was often less than the level of detection for the method of analysis used. A summary of the Hg data for stations 1, 3, and 9-10 is presented below:

Location	Period	n	Dissolved Hg, µg/l (total Hg, µg/l) Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	0.3	0	0.1
	Jan 71 - Jul 71	3	(<0.5)	(0)	(<0.3)
Sta. 3	Oct 70 - Mar 72	18	1.0	0	0.2
	May 71 - Mar 72	9	(1.2)	(<0.5)	(<0.6)
Sta. 9-10	Sep 70 - Mar 72	15	3.1	<0.1	<0.5
	Nov 70 - Jan 71	3	(0.3)	(0.2)	(0.3)

Arsenic (As).

Concentrations of dissolved As monitored in the Kootenai River were low. Mean values for stations 1, 3, and 9-10 were 4, 6, and 2 µg/l, respectively. A summary of dissolved As for the three stations is presented below:

Location	Period	n	Dissolved As, µg/l Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	10	0	<4
Sta. 3	Oct 70 - Mar 72	18	40	0	6
Sta. 9-10	Nov 69 - Jan 72	12	10	0	<2

Chromium (Cr).

Concentrations of Cr monitored in the Kootenai River were very low and maximum values observed were well below levels reported to adversely affect aquatic life. The maximum total Cr concentration observed was 4 µg/l at station 7; the maximum dissolved Cr and hexavalent Cr concentrations observed were 2 and 1 µg/l, respectively. A summary of Cr data for stations 1, 3, and 9-10 is presented below:

Location	Period	n	Dissolved Cr, µg/l Maximum	Minimum	Mean
Sta. 1	May 71 - Mar 72	11	0	0	0
Sta. 3	Oct 70 - Mar 72	17	2	0	0
Sta. 9-10	Nov 69 - Mar 72	9	2	0	0.6

Location	Period	n	total Cr, µg/l Maximum	Minimum	Mean
Sta. 9-10	Oct 70 - Jan 72	7	2	< 1	< 1.3

Location	Period	n	Hexavalent Cr, µg/l Maximum	Minimum	Mean
Sta. 1	Oct 70 - Mar 72	18	1	0	0
Sta. 3	Oct 70 - Mar 72	18	1	0	0

4.1.25 Methylene Blue Active Substances (MBAS).

Presence of MBAS indicates the occurrence of detergents in water. Concentrations of MBAS were sampled only at stations 1 and 3 during the last 1-1/2 years of study. Results indicated traces of detergents at station 1 in November-December 1970 and January 1971, but no detectable amounts thereafter. Only on one occasion during monthly sampling from October 1970 - March 1972 at station 3 has MBAS been detected.

4.2 Bacteriological Data.

4.2.1 Coliform Bacteria.

Sampling for the presence of bacteria of the coliform group was done to obtain an indication of the sanitary quality of the waters of the river. Since coliform bacteria naturally inhabit the soil, vegetation, and water, as well as being normal inhabitants of fecal discharges, the abundance of coliform bacteria is not solely adequate for determination of fecal contamination.

Location	Period	n	Coliforms/100 ml Maximum	Minimum	Mean
Sta. 7	Mar 68 - Sep 69	17	3,600	8	680
	Oct 69 - Mar 72	28	830	1	121
Sta. 8	Mar 68 - Sep 69	12	2,500	55	920
	Oct 69 - Mar 72	28	3,300	16	726
Sta. 9-10	Mar 68 - Sep 69	15	1,400	10	565
	Oct 69 - Mar 72	27	2,400	17	398

Coliform counts ranged from 3,600/100 ml at station 7 in June 1968 to 1/100 ml at the same station in March 1971. Maximum concentrations correlate with periods of high flows. Mean numbers increased between stations 7 and 8 but declined at stations 9-10 during the study.

4.2.2 Fecal Coliforms.

Analyses for fecal coliforms were added to the program at stations 7, 8, and 9 in October 1969. A summary of the results is shown below:

Location	Period	n	Fecal Coliforms/100 ml Maximum	Minimum	Mean
Sta. 7	Oct 69 - Mar 72	29	120	0	19
Sta. 8	Oct 69 - Mar 72	18	260	1	63
Sta. 9	Oct 69 - Mar 72	19	215	1	39

Coliforms of fecal origin ranged from 0 to 260/100 ml. Mean concentrations of 19/100 ml at station 7 increased to 63/100 ml at station 8 and then dropped to 39/100 ml at station 9.

4.3 Bottom Fauna.

Results from the 4 years of sampling involving 230 bottom samples and 50 cylindrical substrate samples showed that the invertebrate population of the Kootenai River was, for all practical purposes, dominated by insects. Only two other major groups of invertebrates were found to be present: Gastropods (snails) probably of the genus Physa and aquatic earthworms and leeches of the Phylum Annelida. These organisms occurred only rarely and formed a rather insignificant part of the number and biomass of aquatic invertebrates present.

Table 6. Listing of insects collected from the Kootenai River, 1968-1971.

Order	Suborder	Family	Subfamily	Genus
Plecoptera	Holognatha (=Filipalpia)	Pteronarcidae		Pteronarcys
				Pteronarcella
		Nemouridae	Capniinae	Capnia
				Isocapnia
			Taeniopteryginae	Brachyptera
			Nemourinae	Nemoura
	Systellognatha (=Setipalpia)	Perlodidae	Isogeninae	Isogenus
				Arcynopteryx
			Isoperlinae	Isoperla
			Perlodinae	Diura
		Perlidae	Acroneurinae	Acroneuria
				Claassenia
		Chloroperlidae	Chloroperlinae	Allerperla
Ephemeroptera		Baetidae	Baetidae	Baetis
				Callibaetis
		Siphlonuridae	Siplonurinae 1/	Ameletus
				Parameletus
		Ephemerellidae	Ephemerellinae 1/	Ephemerella
		Leptophlebiidae	Leptophlebiinae 1/	Leptophlebia
				Paraleptophelbia
		Heptageniidae	Heptageniidae	Heptagenia
				Rhithrogena
				Cinygmula
				Epeorus
				Subgenus-Iron
Trichoptera		Hydropsychidae		Hydropsyche
				Parapsyche
				Arctopsyche
				Cheumatopsyche
		Brachycentridae		Brachycentrus
		Glossosomatidae		Glossosoma
		Rhyacophilidae		Rhyacophila
		Limnephilidae		Neothremma
Diptera	Nematocera	Tendipididae (=Chironomidae)		
		Tipulidae	Tipulinae	Tipula
				Holorusia
			Limoniinae	Hexatoma
		Simuliidae (=Melusinidae)		Simulium
		Tanyderidae		
	Brachycera	Rhagionidae (=Leptidae)		Atherix
		Empididae		
		Tabanidae		
Odonata	Zygoptera	Agrionidae		Agrion
Coleoptera	Polyphaga	Elmidae		
		Hydrophilidae		Hydrophilus
	Adephaga	Dytiscidae		
		Gyrinidae		
Megaloptera		Sialidae		Sialis
Hemiptera		Corixidae		

1/Classified under family Baetidae in Usinger, 1963.

4.3.1 Insects.

A listing of the aquatic insects collected and their taxonomic affinities is shown in table 6. While 51 individual taxa representing eight major insect orders were found to be present, only Plecoptera (stoneflies), Ephemeroptera (mayflies), Trichoptera (caddisflies), and Diptera (true flies) were common. Taxa within these four orders made up over 99 percent of the insects in a sample composed of more than 100,000 insects weighing almost a kilogram (2.2 lb). The remaining 1 percent consisted of Odonata (dragon flies), Coleoptera (beetles, mostly of the family Elmidae), Megaloptera (alderflies), and Hemiptera (aquatic bugs, all in the family Corixidae).

For purposes of clarity, discussion of the results will be confined only to the first four insect orders, with results of bottom and cylindrical substrate sampling being treated separately.

4.3.2 Bottom Sampling.

The 230 bottom fauna samples collected between 1968 and 1971 contained a total of 75,217 insects weighing 713.27 g. This is an average of 327 insects weighing 3.1 g/sq m (equivalent to an insect standing crop of about 300 lb/acre). Summaries of bottom fauna are presented in the appendix, tables 50 through 64.

The insect population, considering all areas combined, increased in both numbers and weight during the period of study. Numbers of insects almost doubled, increasing from a mean of 2,159/sq m in 1968 to 4,124/sq m in 1971. Weight of insects more than tripled, rising from a mean of 19.3 g/sq m to 58.7 g/sq m during the same period.

The trend for an increasing insect population was evident at each of the four sampling locations. Insect populations at the two sampling stations above Libby Dam (stations 1 and 2) appeared to be quite similar, particularly in terms of weight, with 4-year means of 3,918 and 4,582 insects, respectively, weighing 43.7 and 45.9 g/sq m, respectively. Combined, the data from these two stations show an increase from a mean of 2,673 insects weighing 28.8 g/sq m in 1968 to 4,996 insects weighing 78.5 g/sq m in 1971. This is an increase of 187 percent in numbers and 273 percent in weight between 1968 and 1971.

Insect populations at the two stations below Libby Dam were smaller than at the two stations above Libby Dam with 4-year means of 3,027 and 2,553 insects weighing 23.9 and 20.1 g/sq m, respectively. Combined, the data from stations 3 and 4 show an increase from a mean of 1,645 insects weighing 9.9 g/sq m in 1968 to 3,253 insects weighing 38.8 g/sq m in 1971. This is an increase of 198 percent in numbers and 392 percent in weight between 1968 and 1971.

Comparison of the 4-year mean at stations 1 and 2 (4,253 insects weighing 48.4 g/sq m) with the 4-year mean for stations 3 and 4 (2,788 insects weighing 22.0 g/sq m) indicates that the insect population below Libby Dam averaged 66 percent of the population above the dam in terms of numbers and 45 percent in terms of weight.

The similarities and differences between the control and test areas, along with variations in numbers and biomass that occur within the course of each year, are shown in figure 34. Large temporal variations can be noted not only within areas, but between areas. Accepting the fact that insect population data can be highly variable, there appears to be relatively good agreement between the data collected at stations

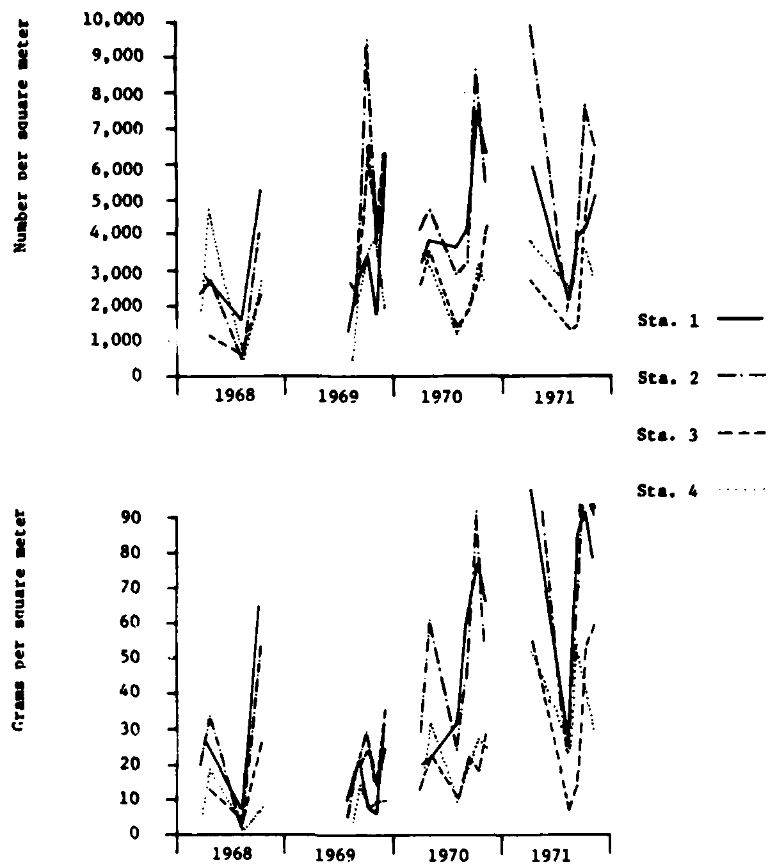


Figure 34. Mean number and weight of insects per square meter at four stations in the Kootenai River, 1968-1971.

1 and 2 and between the data collected at stations 3 and 4. The trend of the insect population at stations 1 and 2, when compared with stations 3 and 4. indicates that some factor, or factors, prevented the populations at stations 3 and 4 from reaching their full potential. This is particularly noticeable in 1970 and 1971.

Plecoptera.

Plecoptera (stoneflies) composed 16 percent of the total number of insects and 29 percent of the total by weight. The mean for all samples was 571 stoneflies weighing 9.6 g/sq m.

Combined, the data from stations 1 and 2 show a mean of 672 stoneflies averaging 13.4 g/sq m while stations 3 and 4 had a mean of 471 stoneflies weighing 5.8 g/sq m. This indicates that the stonefly population below Libby Dam was about 70 percent of the size of the stonefly population above Libby Dam in terms of numbers and 43 percent in terms of weight.

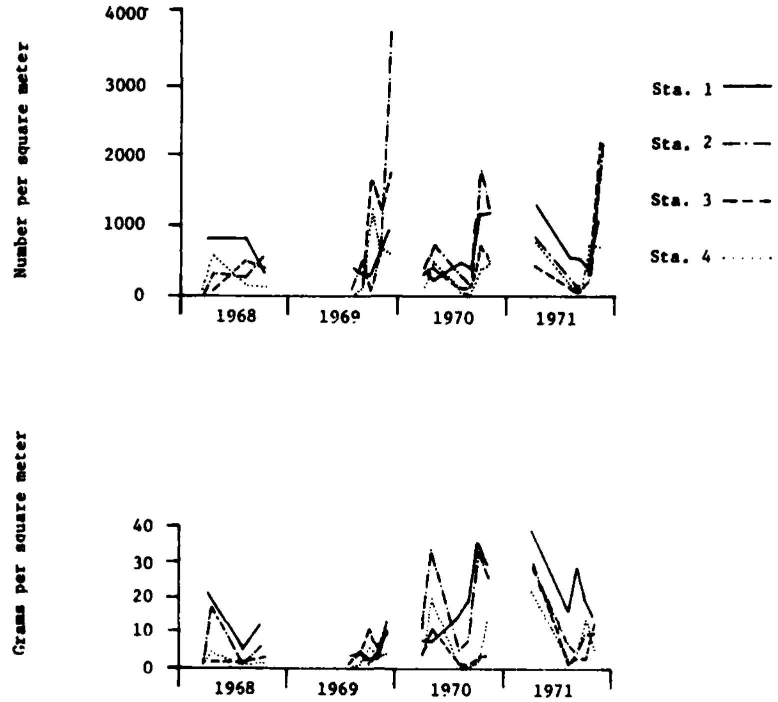


Figure 35. Mean number and weight of Plecoptera per square meter at four locations in the Kootenai River, 1968-1971.

While a generally increasing trend can be noted in the sample means plotted for the stonefly population, as shown in figure 35, the increase is neither as large nor as consistent as that for the insect population as a whole. Number of stoneflies at stations 3 and 4 apparently declined after 1969, but biomass continued to increase. Indications that this decline was probably not of a permanent nature can be seen in the fact that over 2,100 stoneflies/sq m were found at station 3 in November 1971.

A remarkable feature of the data is the mean of 3,771 stoneflies/sq m collected at station 2 in December 1969. These samples were dominated by winter stoneflies of the genus *Capnia* and *Brachyptera* which, due to their small size, were taken in numbers only during this period of the year.

Five stonefly families, containing 13 genera, were found to be present. While an attempt was made throughout the study to identify nymphs to the generic level, identification, particularly of the early instars, was difficult. In some cases confusion appears to have existed in the identification of families. For this reason, no attempt has been made to evaluate the composition of the stonefly population other than to say that the smaller population below Libby Dam seems to be due to a factor, or factors, which affected the order as a whole as opposed to the elimination or reduction of a particular family.

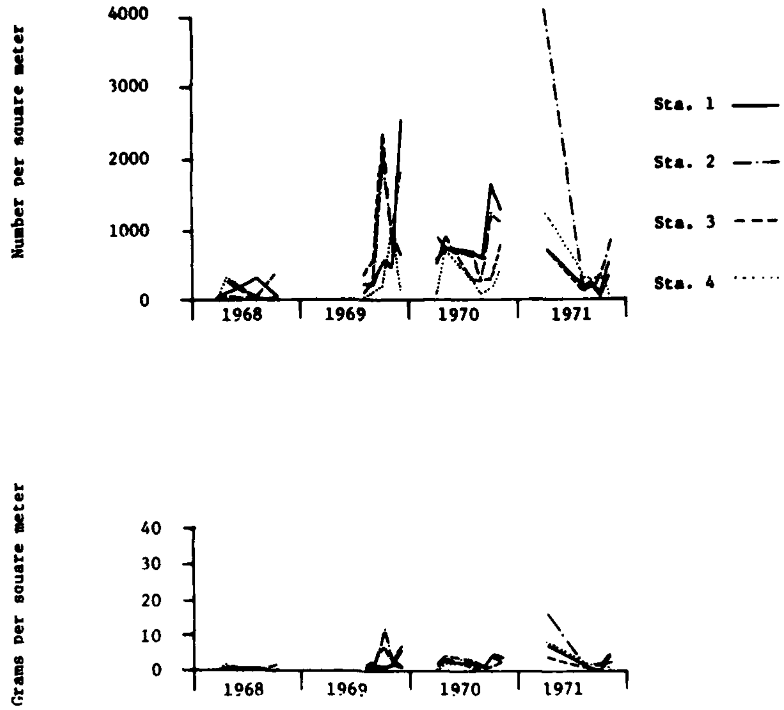


Figure 36. Mean number and weight of Ephemeroptera per square meter at four stations in the Kootenai River, 1968-1971.

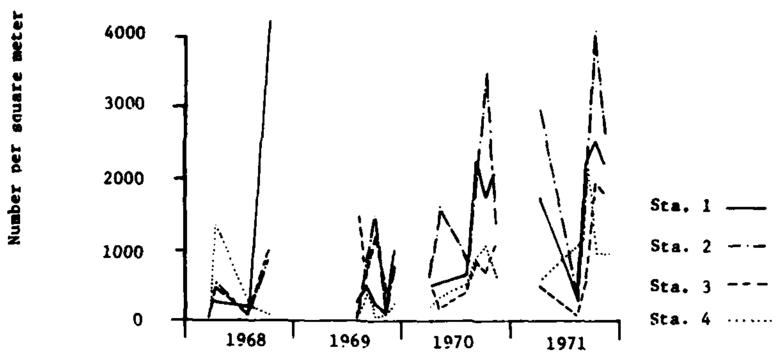
Ephemeroptera.

Ephemeroptera, the mayflies, composed 16 percent of the total number of insects, the same percentage as the stoneflies, but due to their small size they made up only 7 percent of the total weight. The mean for all samples was 554 mayflies weighing 2.2 g/sq m.

Combining the data from stations 1 and 2 shows a mean of 680 mayflies weighing 2.6 g/sq m while stations 3 and 4 had 428 mayflies weighing 1.8 g/sq m. This indicates that the mayfly population below Libby Dam was about 70 percent of the size of the mayfly population above the dam in terms of both numbers and weight.

There was a trend between 1968 and 1969 for an increasing mayfly population at all sampling sites (figure 36). The population at stations 2, 3, and 4 reached the peak in 1969 and progressively declined in 1970 and 1971, while the population at station 1 did not reach its peak until 1970. While relatively good populations were maintained at stations 3 and 4 throughout 1970 and 1971, there is some indication that fall populations failed to reach their full potential as indicated by the control stations.

Five mayfly families, including 11 genera, were found to be present. Baetis constituted 76 percent of the total number of mayflies present and occurred at an overall density of 420/sq m. The two sampling loca-



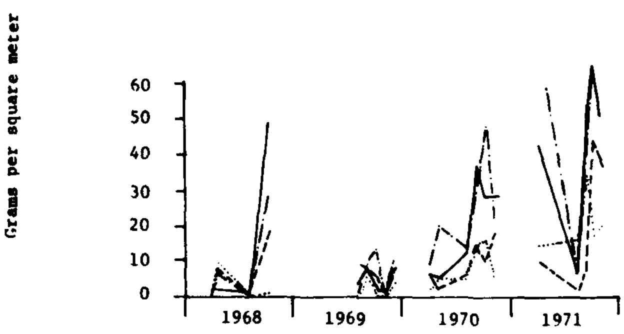


Figure 37. Mean number and weight of Trichoptera per square meter at four stations in the Kootenai River, 1968-1971.

tions below Libby Dam average 317 Baetis/sq m compared to an average of 520/sq m at the two stations above the dam. This indicates that Baetis were considerably more abundant above the project than below. Ephemerella, which made up 11 percent of the total number of mayflies taken, averaged 62/sq m, with the population below the dam being 77 percent of the size of that above the dam.

Trichoptera.

Trichoptera (caddisflies) composed 27 percent of the total numbers of insects and nearly half (49 percent) of the sample by weight. The mean for all samples was 960 caddisflies weighing 16.4 g/sq m.

Combined, the data from stations 1 and 2 show a mean of 1,276 caddisflies/sq m with a weigh of 22.6 g/sq m, while stations 3 and 4 had a mean of 643 caddisflies/sq m with a weight of 10.1 g/sq m. This indicates that the caddisfly population below Libby Dam was about 50 percent of the size of the caddisfly population above Libby Dam in terms of numbers and 45 percent in terms of weight.

Rather extraordinary increases in both numbers and weight that occurred throughout the course of the study can be seen in figure 37.

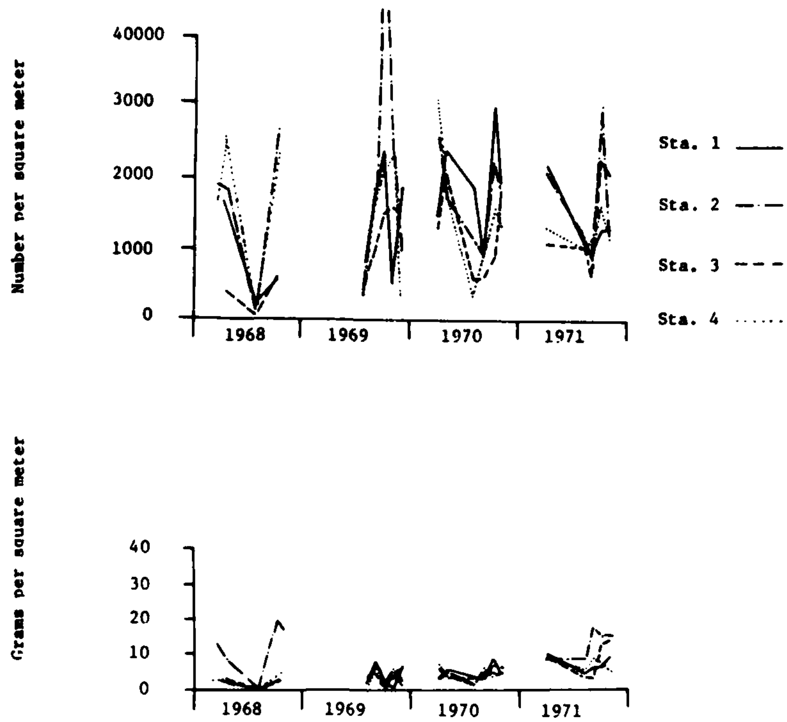


Figure 38. Mean number and weight of Diptera per square meter at four stations in the Kootenai River, 1968-1971.

The caddisfly population above the dam, and particularly at station 2, increased by many orders of magnitude between 1968 and 1971, with individual samples taken in October 1970 and 1971 totaling more than 6,000 caddisflies/sq m with sample means of from 3,000 to 4,000/sq m. With few exceptions, caddisflies were more abundant at stations 1 and 2 than at stations 3 and 4 in 1970 and 1971, again indicating the existence of some factor affecting the population below the dam site.

Five caddisfly families were noted during the course of the study and, with the possible exception of the Limnephilidae which occurred only during the early years of study, no substantive changes have been noted in the diversity of the population. Representatives of the family Hydropsychidae made up 94 percent of the caddisfly population, with the genus Hydropsyche dominating. The major trends in the population are therefore due to fluctuation occurring among the members of this family.

Diptera.

Diptera, the true flies, composed 41 percent of the total number of insects, but, due to the small size of the dominant family (Tendipididae), members of this insect order made up only 15 percent of the sample by weight. The mean for all samples was 1,428 Diptera weighing 5.2 g/sq m.

Combined, the data from stations 1 and 2 show a mean of 1,613 Diptera weighing 6.1 g/sq m, while stations 3 and 4 had a mean of

1,243 Diptera weighing 4.3 g/sq m. This indicates that the Diptera population below Libby Dam was about 77 percent of the size of the population above Libby Dam in terms of numbers and 70 percent in terms of weight.

Population trends for Diptera are shown in figure 38. Although Diptera biomass exhibits an increasing trend, the population in terms of numbers seems to be stable. Only numbers of true flies at stations 1 and 3 appear to have increased. The most notable feature of the data is the relatively similar population levels found in both control and test areas.

Seven families were found to be present, but the most important by far were members of the family Tendipididae (=Chironomidae), or midges, which made up 97 percent of the total Diptera.

4.3.3 Cylindrical Substrate Sampling.

A total of 50 cylindrical substrate samples were collected during the years 1968 and 1969 containing 29,934 insects weighing 228.23 g (thereby averaging 539 insects weighing 4.6 g/sample). Summaries of the cylindrical substrate sampling data are contained in the appendix, tables 65 through 67.

The number of insects/samples increased from 374 in 1968 to 679 in 1969 while at the same time biomass decreased from 6.3 g/sample in 1968 to 3.1 g/sample in 1969. Insects at station 3 below the dam occurred in considerably larger numbers than at the two stations above the dam during both years of study. In 1968, station 3 averaged 754 insects/sample and this increased to 1,161 insects/sample in 1969. Biomass, however, decreased from 12.7 g in 1968 to 4.9 g/sample in 1969. Numbers increased from 131 insects/samples at stations 1 and 2 in 1968 to 438 insects/sample in 1969. Biomass, however, remained stable, averaging 2.1 g/sample in 1968 and 2.2 g/sample in 1969. Figure 39 shows the average number and weight of insects taken at each of the three sampling stations.

It is evident that unusually large numbers of caddisflies dominated the insect population and constituted 58 percent of the total number of insects collected. The dominating influence of caddisflies was particularly evident at station 3 both in September 1968 and September 1969 (figure 40). The three September 1968 samples averaged 1818 caddisflies weighing 31.3 g/sample and the three September 1969 samples averaged 1614 caddisflies weighing 8.74 g/sample. A notable feature of the data is the sharp insect population decline in the samples taken late in the year.

Population trends for Plecoptera are shown in figure 41. Plecoptera which averaged 35/sample in 1968 increased to 105/sample in 1969, largely due to the large numbers occurring at stations 2 and 3. Somewhat similar trends are shown for Ephemeroptera (figure 42) and Diptera (figure 43).

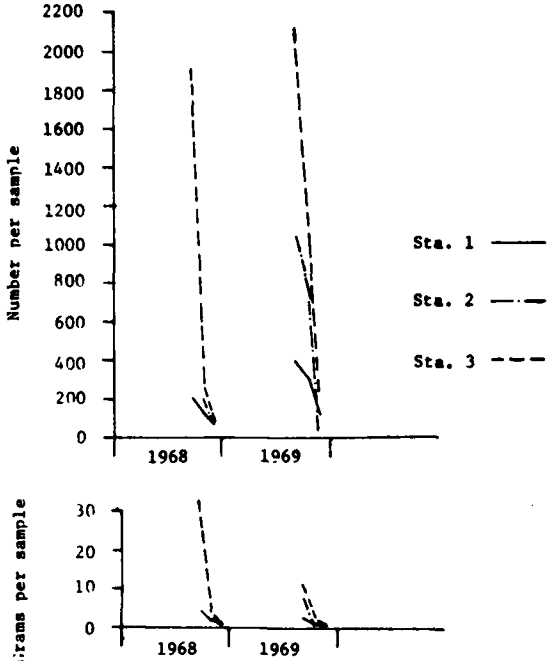


Figure 39. Mean number and weight of insects per cylindrical substrate sample at three stations in the Kootenai River, 1968 and 1969.

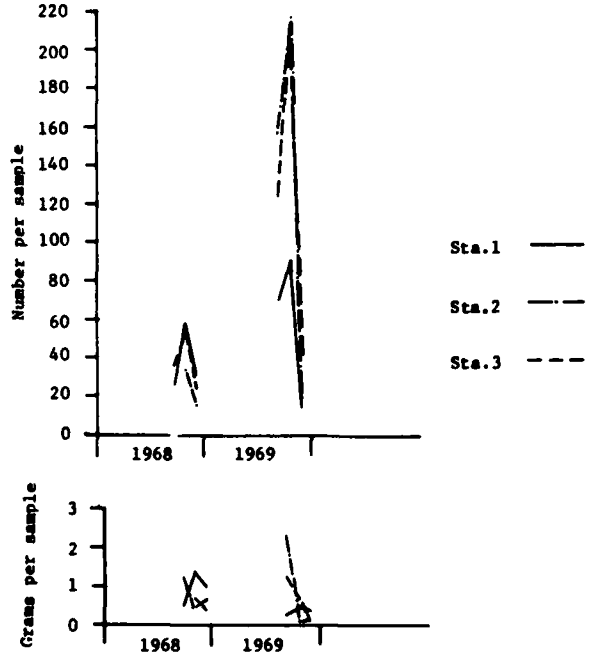


Figure 40. Mean number and weight of Plecoptera per cylindrical substrate sample at three stations in the Kootenai River, 1968 and 1969.

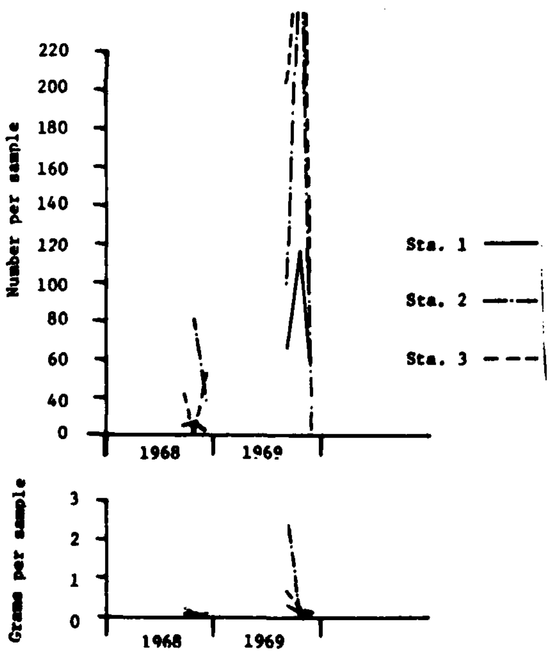


Figure 41. Mean number and weight of Ephemeroptera per cylindrical substrate sample at three stations in the Kootenai River, 1968 and 1969.

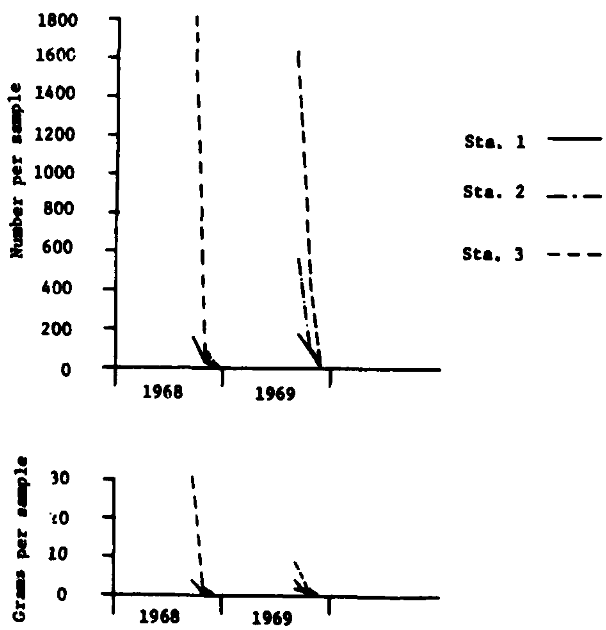


Figure 42. Mean number and weight of Trichoptera per cylindrical substrate sample at three stations in the Kootenai River, 1968 and 1969.

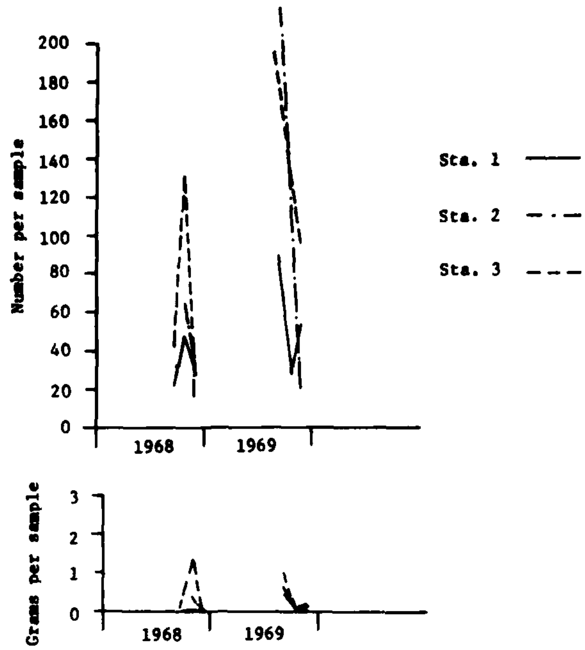


Figure 43. Mean number and weight of Diptera per cylindrical substrate sample at three stations in the Kootenai River, 1968 and 1969.

5.0 DISCUSSION

The Kootenai River is the second largest tributary of the Columbia River, with a discharge of nearly 800 cu m/sec (28,200 c.f.s.). The river, which has a length of about 780 km (485 miles) and a basin of almost 50,000 sq km (19,300 sq miles), is shared by Canada and the United States. Most of the river and its basin, along with the source and mouth of the river, lie in Canada. About one-third of the river's length and one-quarter of the basin area lie within the United States. The portion of the basin within the United States produces about one-fifth of the water discharged at the river mouth.

Practically all of the water that passes the background station at Rexford, near the Canadian-United States border, originates in Canada. At the Libby Dam site, about 90 percent of the water originates in Canada. The Canadian contribution of runoff in the river declines to 63 percent at the downstream border station near Porthill, Idaho. The water quality characteristics at the upstream station are, thereby, largely determined within the Canadian portion of the basin. Some of the many factors affecting water quality in the basin are delineated in previous reports (U.S. Army Corps of Engineers, 1969, 1970 and 1971) and by Shurr (1969) and Northcote (1972, 1973). Factors affecting water quality in the Canadian portion of the Kootenai River are discussed in the Canadian report (Crozier and Leinweber, 1975) published concurrent with this report to document the water quality of the river prior to impoundment by Libby Dam.

River discharge for the study period was 106 percent of normal, based on the period 1910-1972. River discharge of 118 to 120 percent of normal characterized the years 1967, 1969, and 1971. The year 1968 was a normal year in respect to discharge and 1970 was a low water year having 75 percent of normal flow.

Wide seasonal fluctuations in discharge are characteristic of the river. Flows entering the United States between calendar years 1967-1971 ranged from 37 to 1994 cu m/sec (1,300 to 70,376 c.f.s.) with a mean of 309 cu m/sec (10,906 c.f.s.). The range at Porthill is 74 to 2,784 cu m/sec (2,620 to 98,300 c.f.s.) with a mean of 488 cu m/sec (17,247 c.f.s.). Roughly, 70 percent of the river's mean annual flow occurs during the spring and early summer. These fluctuations have rather dramatic effects upon the quality of the water. Suspended sediment concentrations, which are low during periods of base flow, increase during high water, while dissolved solids concentrations, which are high during base flow, decrease during high flows. With the bulk of the discharge occurring during the months of May, June, and July, dissolved and suspended loadings increase and are higher during that period than in the entire remaining 9 months of the year.

During the preimpoundment study period, the Kootenai River was a fast-flowing, cold-water river containing moderately hard to hard water of the calcium bicarbonate type. The river was quite fertile, as indicated by the high dissolved solids content and a large and diverse aquatic insect population. Dissolved oxygen concentrations invariably remained at or near saturation. High dissolved oxygen concentrations, along with the relatively low observed values for biochemical oxygen demand, indicate that the river was effective in assimilating organic loads without respiratory stress to aquatic life. For about 8 months of each year, the water was clear, transparent, and almost colorless. During periods of high discharge the river picked up a large suspended sediment load and became turbid and the true color increased. Increases could also be detected in total coliforms during periods of high water, but human contamination was not indicated since fecal coliforms were generally low (and within Montana's water quality standards for the river). The pH of the river water was often rather high for natural waters and the free carbon dioxide content, which strongly influences the pH, was generally low. The water, with bicarbonate as the dominant anion, had a high alkalinity which gave the river a high "buffering capacity."

Dissolved solids content of streams entering the Kootenai River from the Cabinet and Purcell Mountains was lower than that of the Kootenai and the river became more dilute as it traversed the United States; there was, however, an overall increase in the total dissolved solids load. This same phenomenon was noted to occur with most of the major ions as well as with suspended sediments.

An important feature of the study was the detection of an abrupt decrease in a number of water quality parameters in the Kootenai River in September 1968 which could be attributed to treatment of an industrial discharge entering the St. Mary River, a tributary of the Kootenai

River in British Columbia. The decrease was observed to occur in the concentrations of Ca, SO_4, F, and PO_4 and was reflected in specific conductance and hardness determinations.

Concurrent with the reduction of the above stated water quality parameters was an observed change in the aquatic insect population. The population of aquatic insects increased between 1968 and 1969 and remained high throughout the remainder of the study. Such strongly suggests that the chemical changes in the river, following the waste water treatment of the industrial discharge in British Columbia, had a beneficial effect on the insect population.

Concentrations of trace elements monitored in the river were low or within the range characteristic of natural waters, except for Zn, Ba, and Sr. Only Zn, however, was observed in concentrations which may have, at times, exerted sublethal effects on aquatic organisms in the river.

The high F concentrations observed during the early part of the study were of concern as the concentration approached and, at times, exceeded, particularly at low flow, the level considered to be toxic to aquatic life (McKee and Wolf, 1963). As stated above, the F concentration significantly decreased after 1968.

Ammonia concentrations observed in the river were often very high; levels as high as 0.93 mg/l were observed. The mean level at the upstream border station was 11 mg/l. The high observed concentrations of NH_3 indicate that NH_3 toxicity may have been a problem in the upper reaches of the river. The high pH of the Kootenai River would have tended to increase the toxicity of ammonia.

Na and Cl concentrations increased during the study period. While the reason for the increase is not entirely clear, increases in industrial and domestic wastes are suspect.

Concentration of P in the Kootenai River as it entered the United States was high, particularly in 1967 and 1968. Mean Ortho-P concentrations for 1967, 1968, 1969, 1970 and 1971 were 0.52, 0.42, 0.08, 0.12, and 0.06 mg/l, respectively. Total P was not monitored at the upstream border station until mid-1969; the mean concentration for 1969-71 ranged from 0.18 to 0.21 mg/l. The high P concentrations in the river are attributable to the waste discnarges of a fertilizer plant to the St. Mary River in British Columbia (Northcote, 1972, 1973). Despite the waste water controls of the fertilizer industry in 1968, the levels in the river remained high.

Lower mean total and Ortho-P concentrations were characteristic of the downstream stations as the result of dilution from low P runoff waters to the river, to a loss of P by sedimentation processes, and to uptake by aquatic organisms.

Ortho-P loading of the Kootenai River entering the United States is estimated to have been in excess of 3,000 metric tons/year in 1968, declining to around 785 metric tons/year for the remainder of the study period. Northcote (1973) indicates that the PO_4-P loading of the Kootenai River below its confluence with the St. Mary River has approached

1,000 metric tons/annum since the 1960's. Total P loading for 1970 and 1971 is estimated to have been in the order of 2,000 metric tons/year.

Total N concentrations of the Kootenai River entering the United States were high. The mean for September 1969 through March 1972 was 0.41 mg/l. On the average, organic -N, NO_3-N, NO_2-N, and NH_3-N were 34, 38, 2, and 26 percent of total N, respectively. Upon leaving the United States, the percent of total N in the river that was organic increased to 39 percent, while the percent that was NO_3-N and NH_3-N decreased to 36 and to 23 percent, respectively.

The N loading of the Kootenai River entering the United States is estimated to have been in excess of 3,000 metric tons/year for 1970 and 1971.

Concern for the development of eutrophic conditions in the reservoir (Lake Koocanusa) formed by impoundment of the Kootenai River by Libby Dam, as a result of high P concentrations and loadings in the river, has been expressed since initiation of the preimpoundment study. According to the best available guidelines on permissible P loading for lakes (Vollenweider, 1968 1973), Lake Koocanusa will be receiving sufficient P to place it well into the category of eutrophic lakes if the P loading of the Kootenai River remains consistent with that found for 1969-1972. The annual P loading expressed per unit lake surface area would be in the order of 10 g/m^2, the estimate being based on a conservative estimate of total P loading, 1,500 metric tons/yr, and an average lake elevation of 738 meters (2,420 ft) with an average surface area of 1.5 x 10^8 m^2 (3.75 x 10^3 acres). For a lake with the mean depth (43 m (113 ft)) and retention time (0.5 yr) expected for Lake Koocanusa, the "permissible" and "dangerous" P loading levels in regard to eutrophication given by Vollenweider (1973) are 1.0 and 2.0 g/m^2 yr, respectively. The total P loading estimated for Lake Koocanusa will be an order of magnitude greater than the "permissible" guideline presented by Vollenweider and the dissolved P loading will be approximately 4 times the guideline for "permissible" loading in respect to eutrophication. The dissolved portion would provide an immediate source of P for algal growth.

The critical concentration of N in a lake at the beginning of the growing season above which excessive algae blooms may be expected to occur is 0.2-0.3 mg/l when P concentrations are from 0.01 to 0.02 mg/l (Sawyer, 1947; Mackenthun, 1965; Vollenweider, 1968). The mean N concentration of the Kootenai River upon entry into the United States was 0.41 mg/l while the P concentration was an order of magnitude greater than the critical 0.02 mg/l value. The "permissible" and "dangerous" N loading level in respect to potential development of eutrophic conditions for a lake with the mean depth expected for Lake Koocanusa is predicted at 4 g/m^2 yr and 8 g/m^2 yr, respectively (Vollenweider, 1968). The estimated loading to Lake Koocanusa, based on river loading for the study period, is 20 g/m^2 yr, of which about two-thirds is inorganic N.

Although the exact biological response of a lake to nutrient enrichment is exceedingly difficult to determine, the state of the art does allow statements regarding a lake if it is threatened. It is noteworthy that Vollenweider's loading criteria in relation to development of eutrophic conditions in a lake are in excellent agreement with limnological experience. Lake Koocanusa can be expected to develop eutrophic conditions, particularly nuisance algae blooms, if P and N loading remains consistent with that found during this study.

The high nutrient content of the Kootenai River has resulted in eutrophic conditions developing in Kootenay Lake. The principal inflow to Kootenay Lake is the Kootenai River and, according to Northcote (1972, 1973), the accelerated eutrophication of Kootenay Lake is attributable to the single industrial outfall on the St. Mary River which is the major source of P in the Kootenai River. Northcote reports that the biological changes that have occurred in Kootenay Lake since the industry began to discharge to the St. Mary River have been increased algae abundance with extensive blooms occurring in some years and localized blooms on others. The extensive algae blooms have been reported to impart offensive odor and taste to the water and to fish.

The effect of dam construction on the river water quality appeared to be limited to increases in suspended sediment and turbidity. During the study period, the increase in suspended sediment between the sampling stations upstream and downstream of the dam site averaged around 10 percent. For short periods of time, considerable increases in suspended sediment did occur, however, particularly during the periods of high discharge in 1968 and 1969. The two major events which led to large increases in suspended sediment and turbidity were the river diversions for the first and second stage cofferdam construction.

The aquatic insect population for 14.5 km (9 miles) below the Libby Dam site was found to be smaller than the population above the dam site. The supression of the insect population below the dam is attributed to the increase in suspended sediment caused by construction activities related to the Libby Dam Project.

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APPENDIX: WATER QUALITY DATA AND RELATED INFORMATION FOR THE UNITED STATES REACH OF THE KOOTENAI RIVER FOR THE PERIOD OCTOBER 1967 THROUGH MARCH 1972

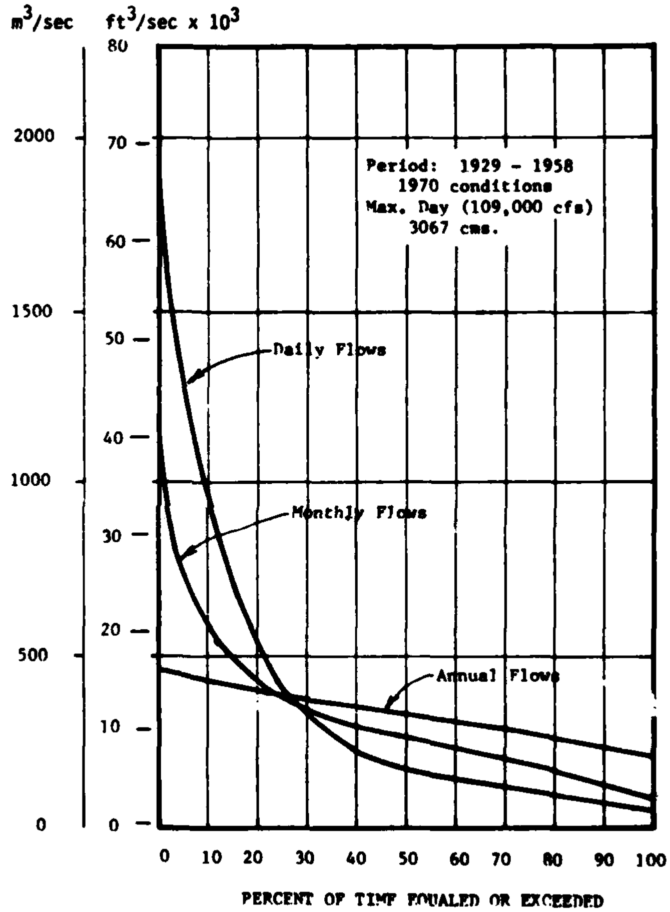

Figure 1. Duration curves, Kootena River at Libby, Montana.

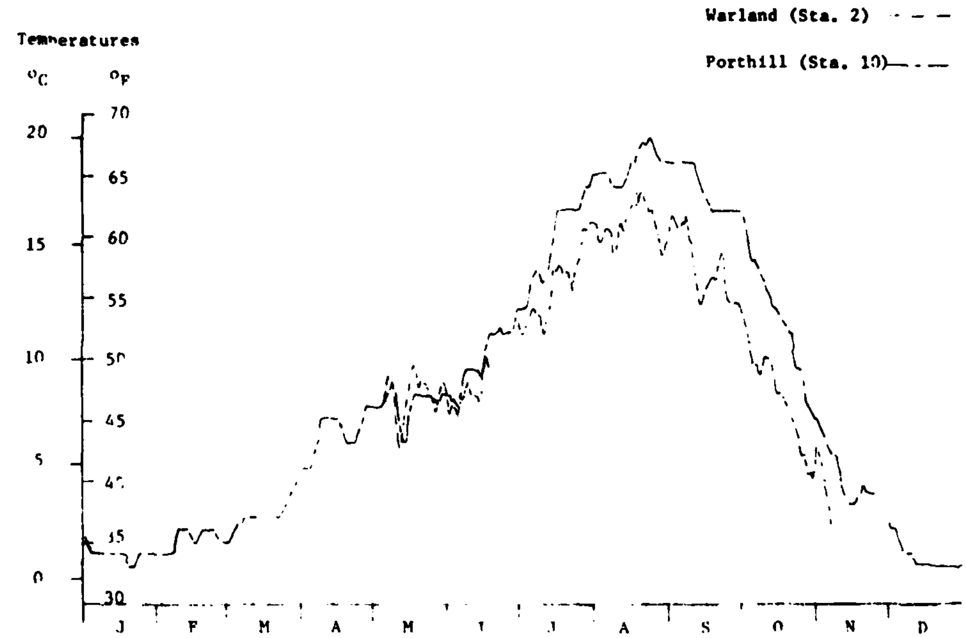

Figure 2. Mean daily water temperatures in the Kootenai River, 1967.

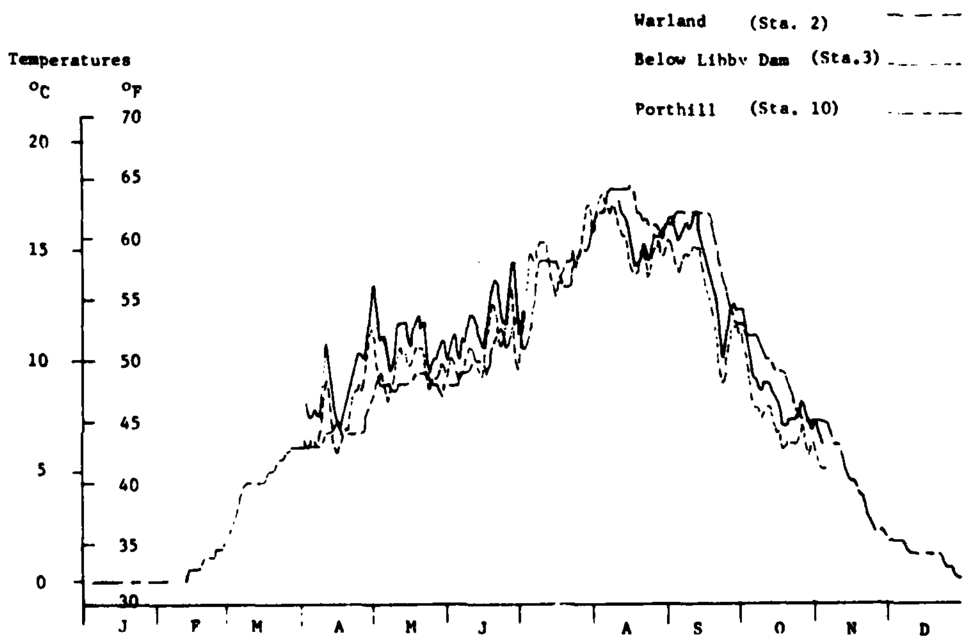

Figure 3. Mean daily water temperatures in the Kootenai River, 1968.

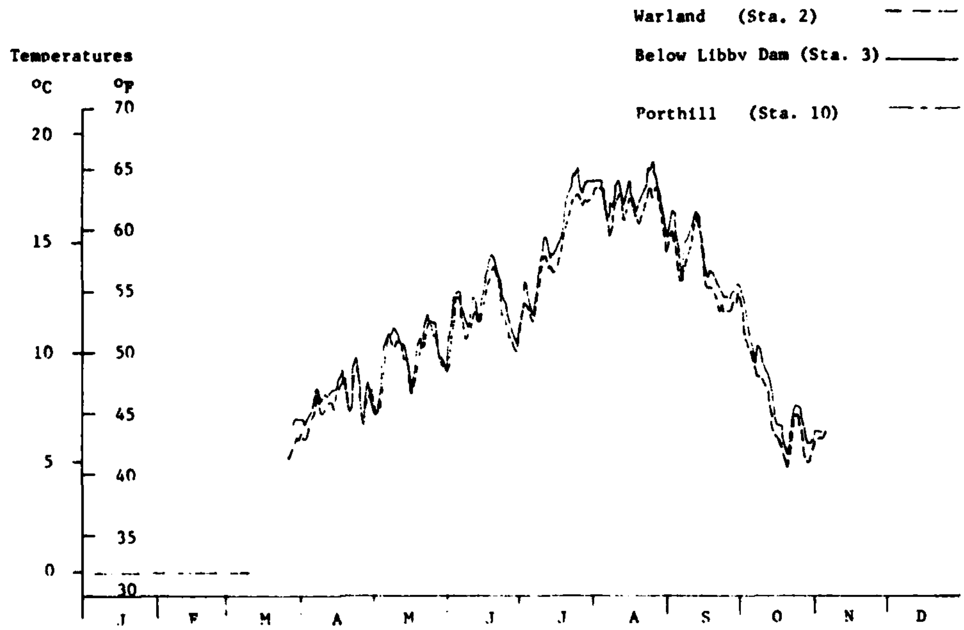

Figure 4. Mean daily water temperatures in the Kootenai River. 1969.

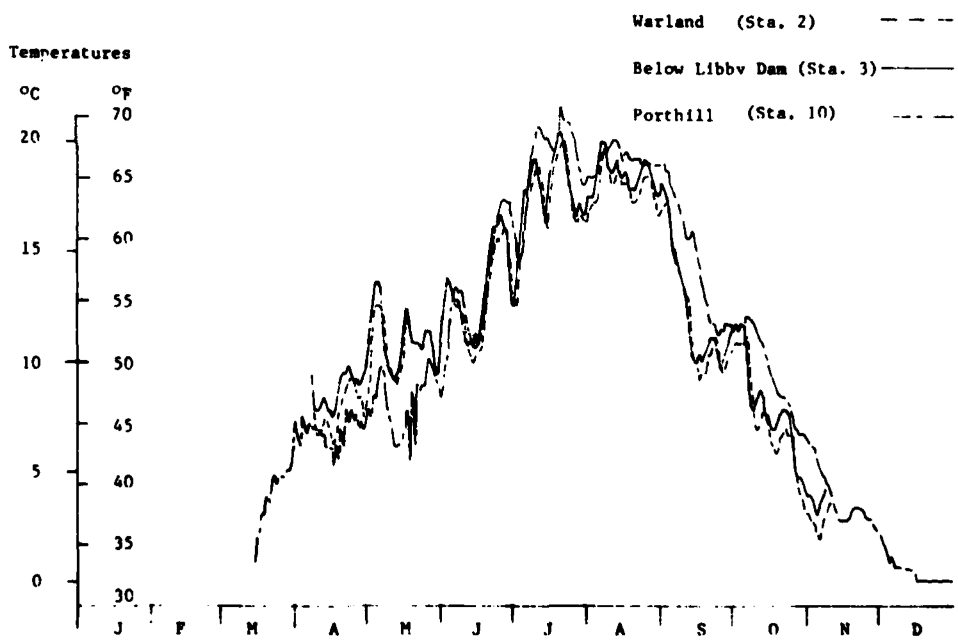

Figure 5. Mean daily water temperatures in the Kootenai River, 1970.

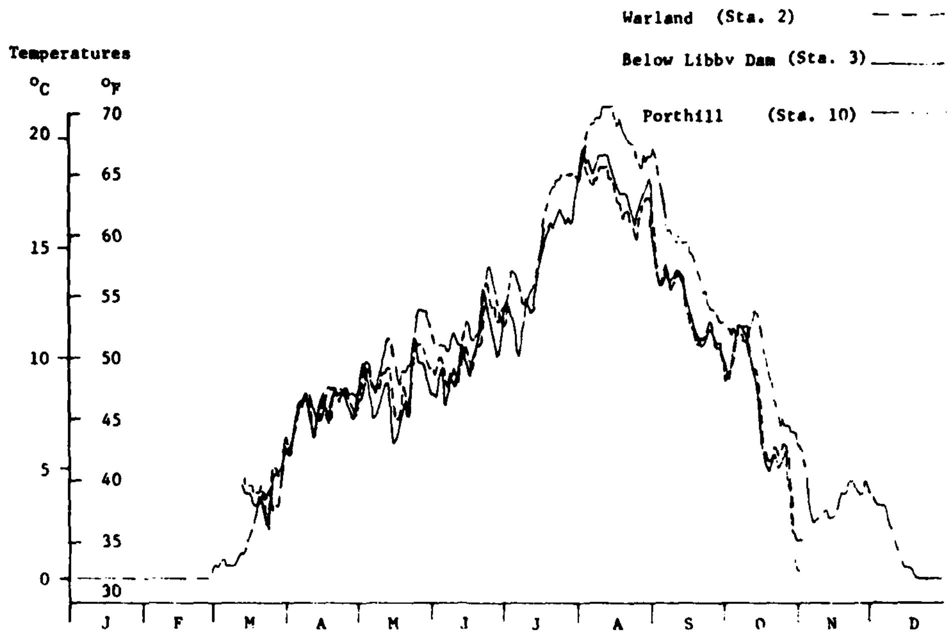

Figure 6. Mean daily water temperatures in the Kootenai River, 1971.

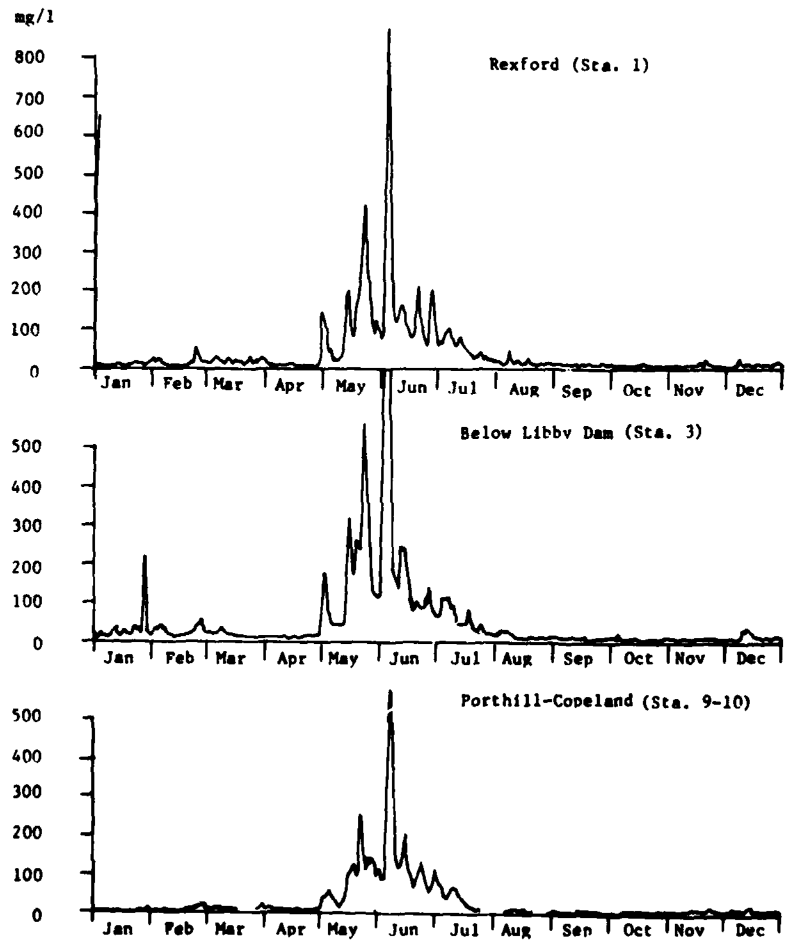

Figure 7. Suspended sediment concentrations in the Kootenai River, 1968.

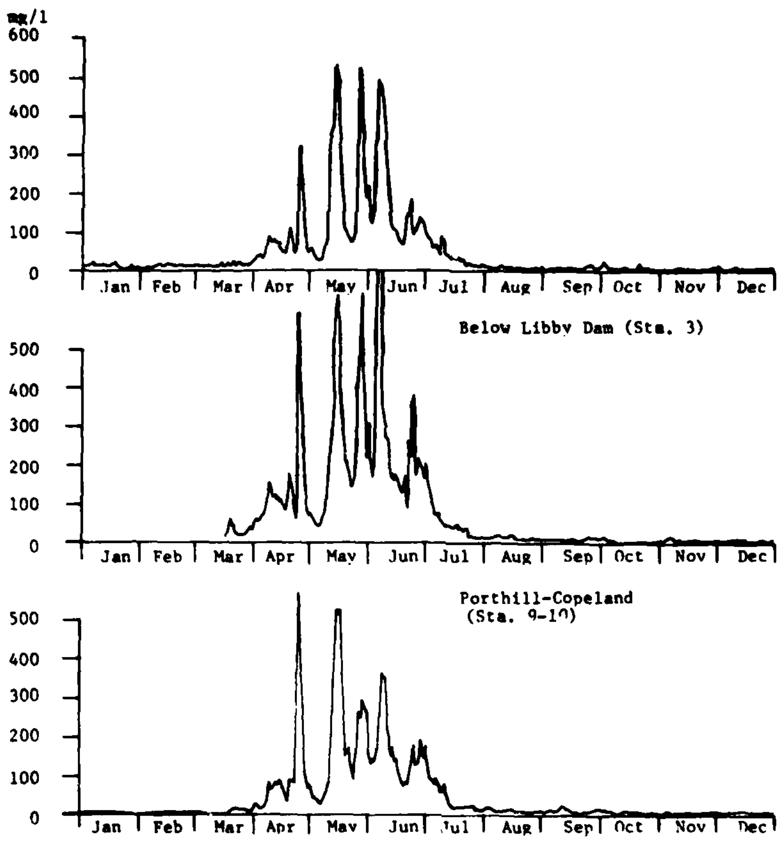

Figure 8. Suspended sediment concentrations in the Kootenai River, 1969.

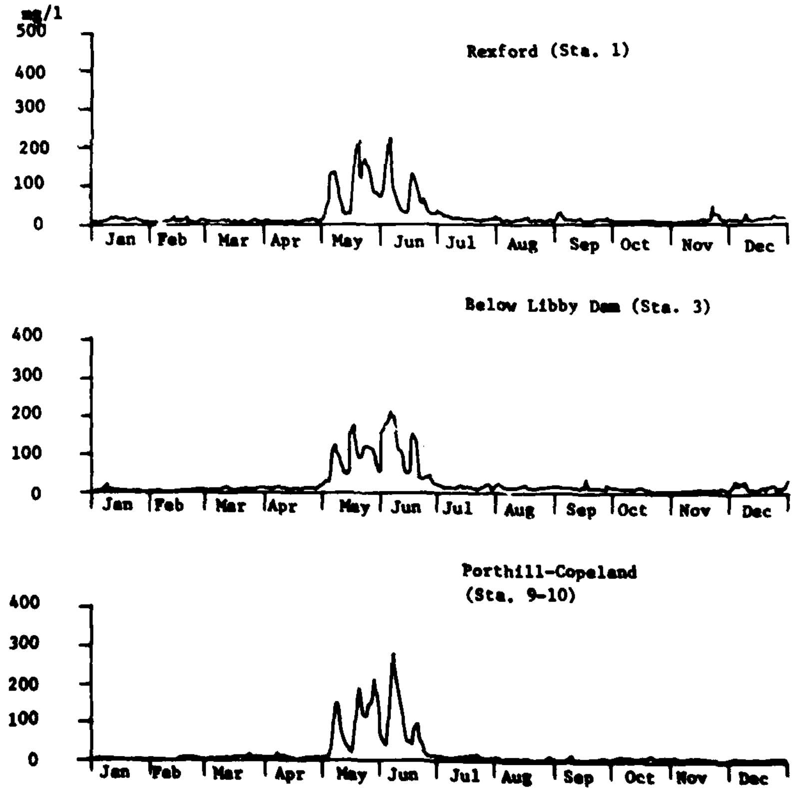

Figure 9. Suspended sediment concentrations in the Kootenai River, 1970.

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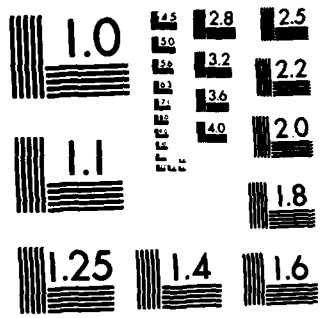

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NATIONAL BUREAU OF STANDARDS-1963-A

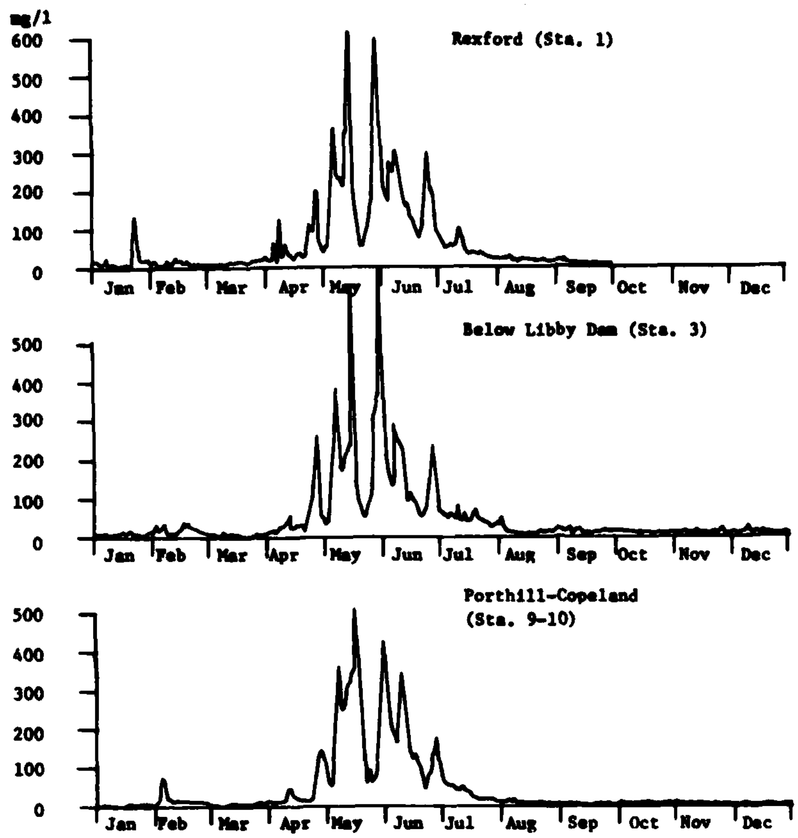

Figure 10. Suspended sediment concentrations in the Kootenai River, 1971.

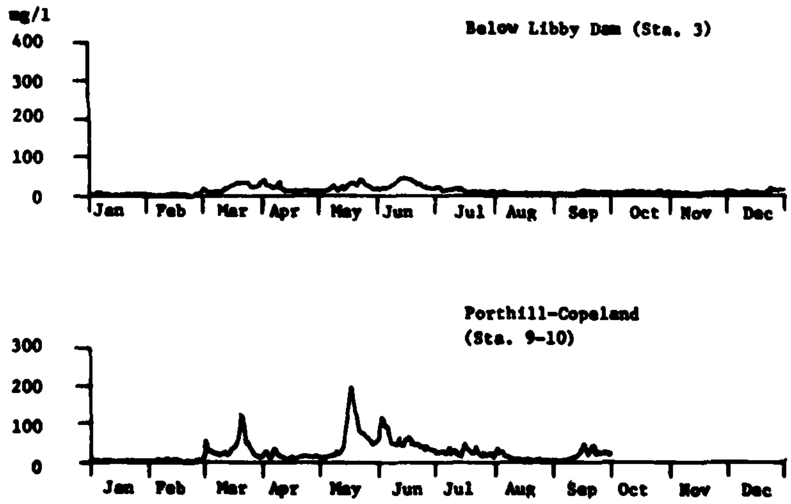

Figure 11. Suspended sediment concentrations in the Kootenai River, 1972.

Table 1. Drainage Area and Discharge at Selected Gaging Stations in the Kootenai River Basin.

Location	Drainage Area Sq. Mi.	Discharge Mean ann. c.f.s.	Runoff in/yr	Runoff ac-ft/yr x 10^3	Period of Record
Kootenay River Newgate, B.C.	7,660	10,520	18.65	7,622	Oct 30 - Mar 72 (41 years)
Tobacco River Eureka, Mont.	440	285	8.80	206.5	Sep 58 - Sep 72 (14 years)
Kootenai River Rexford, Mont.	8,[illegible]20	10,130	16.34	7,339	Mar 29 - Nov 40 Oct 67 - Sep 71 (15 years)
Kootenai River Warland, Mont.	8,892	11,920	18.20	8,636	Jul 61 - Sep 71 (10 years)
Kootenai River Libby Dam, Mont.	8,985				Dec 68 - Sep 72
Fisher River Libby, Mont.	838	604	9.79	437	Sep 67 - Sep 72 (5 years)
Kootenai River Libby, Mont.	10,240	12,170	16.14	8,817	Oct 10 - Sep 72 (62 years)
Yaak River Troy, Mont.	766	940	16.67	681	Oct 10 - Sep 16 Mar 56 - Sep 72 (16 years)
Kootenai River Leonia, Id.	11,740	14,060	16.26	10,190	Mar 28 - Sep 72 (44 years)
Moyie River Eileen, Id.	755	888	15.98	643	Oct 25 - Sep 72 (47 years)
Kootenai River Copeland, Id.	13,400	15,750	15.95	11,410	Oct 27 - Sep 72 (43 years)
Kootenai River Porthill, Id.	13,700	16,120	15.98	11,680	May to Jul 04 & Oct to Mar 28 & Apr 28 to Sep 72 (44 years)

Source:
U.S. Geological Survey, 1972. Water Resources Records for Montana. Part 1. Surface Water Records
U.S. Geological Survey 1972. Water Resources Records for Idaho. Part 1. Surface Water Records.

Table 2. Waste Source Discharges in the Kootenai River Basin Prior to 1972.[1]

Source	Type of Treatment	Receiving Water	Volume MGD (m^3/day)	TSS mg/1 (kg/day)	BOD^5 mg/1 (kg/day)	COD mg/1 (kg/day)	pH	Fecal Coliform no/100 ml	P.Z. Raw	P.Z. Treated
City of Eureka	Primary with Chlorination (Spiragester)	Tobacco R.	0.1 (378.5)	70 (26)		134 (51)	6.7	$17x10^6$	1100	800
City of Libby	Primary with Chlorination	Kootenai R.	1.0 (3785)	46 (174)	105 (397)	100 (378)	7.3	$42x10^4$	3000	2000
St. Regis Co. (Sewage)	Secondary Trickling Filter	Kootenai R.	0.07 (265)	50 (13)	25 (7)		6.5-7.2		250	88
St. Regis Co. (log pond)	Settling ponds	Kootenai R.	13.6 (51476)	22 (1134)	5 (258)	35 (1805)	6.5-7.3	350		
W. R. Grace Co.	Complete Retention Recycle 2/	Rainy Cr.	none							
Granite Concrete	Settling Ponds	Libby Cr.	none							
City of Bonners Ferry	Aerated Lagoon	Kootenai R.	0.2 (757)	20+	20		7.5-8.0		2000	

1/Source reference: Nunnallee and Boltz, 1973; Water Quality Inventory and Management Plan, Kootenai River Basin, Montana. Montana Department of Health and Environmental Sciences. Helena, Montana. Jones, Roy. 1975. Personal Communication, Superintendent, City of Bonners Ferry Power and Light, 17 March 1975.

2/Facilities completed in 1971.

Table 3. Fish Species Known to Occur in the Kootenai River Prior to the Impoundment by Libby Dam

Common Name	Scientific Name
White Sturgeon[1]	*Acipenser transmontanus*
Dolly Varden trout	*Salvelinus malma*
Brook trout[2]	*Salvelinus fontinalis*
Cutthroat trout	*Salmo clarki*
Rainbow trout[3]	*Salmo gairdneri*
Kokanee[1]	*Oncorhynchus nerka*
Mountain whitefish	*Prosopium williamsoni*
Pygmy whitefish[1]	*Prosopium coulteri*
Burbot	*Lota lota*
Northern squawfish	*Ptychocheilus oregonensis*
Largescale sucker	*Catostomus macrocheilus*
Longnose sucker	*Catostomus catostomus*
Peamouth chub	*Mylocheilus caurinus*
Redside shiner	*Richardsonius balteatus*
Longnose dace	*Rhinichthys cataractae*
Prickley sculpin	*Cottus asper*
Slimy sculpin	*Cottus cognatus*
Largemouth bass[2]	*Micropterus salmoides*
Pumpkinseed sunfish[2]	*Lepomis gibbosus*

1. Known only from below Kootenai Falls.
2. Introduced.
3. Present, but probably introduced above Kootenai Falls; indigenous below.

Table 4. Methods of Chemical Analysis used by the U.S. Geological Survey in Libby Dam Pre-Impoundment Studies

Parameter	Method of Analysis	Note
Alkalinity	Volumetric, Poteniometric	Method changed July 1969
Aluminum	Ferron - orthophenanthroline	
Arsenic	Silver diethyldithiocarbamate	
Barium	Complexometric	
Beryllium	Atomic absorbtion	
Bicarbonate	(see alkalinity)	
Boron	Dianthrmide	
Cadmium	Atomic absorbtion	
Calcium	Complexometric, atomic absorbtion	A.a.s. adopted prior to Dec 69
Carbon, total organic	Carbonaceous analyzer	
Carbon dioxide	Calculation	
Carbonate	(see alkalinity)	
Chloride	Mercurimetric	
Chromium	Atomic absorbtion	
Cobalt	Atomic absorbtion	
Color	Comparison	
Copper	Atomic absorbtion	Method changed July 1969
Fluoride	Zirconium - eriochrome cyan. R	
Hardness	Complexometric	
Iron	Bipyridine	
Lead	Atomic absorbtion	
Lithium	Atomic absorbtion	Method changed July 1969
Magnesium	Atomic absorbtion	Method changed July 1969
Manganese	Atomic absorbtion	Method changed July 1969
MBAS (detergents)	Standard	
Molybdenum	Dithiol	
Nickel	Atomic absorbtion	
Nitrogen, ammonia	Distillation - nesslerization	Method changed July 1969
Nitrogen, nitrate	Phenoldisulfonic acid, Brucine	Brucine adopted Apr 1969
Nitrogen, nitrite	Diazotization	Method changed July 1969
Nitrogen, organic	Kjeldahl	Method changed July 1969
Oxygen, dissolved	Azide Idometric or Instr.	
Oxygen demand, BOD	Standard	
Oxygen demand, COD	Standard	
Phenolic cpds.	Gibbs reaction, 4-Aminoantipyrine	Method changed July 1969
Phosphorus	Phosphomolybdate (Persulfate oxidation)	Method changed Feb 1969
Potassium	Flame photometry, Atomic absorbtion	
Selenium	Diaminobenzidine	
Silica	Molybdate blue	Method changed July 1969
Silver	Atomic absorbtion	
Sodium	Flame photometry, Atomic absorbtion	A.a.s. introduced after Dec 1969
Solids, dissolved	Residue-on-evaporation	
Solids, suspended	Filtration	
Specific conductance	Instrumental	
Strontium	Atomic absorbtion	
Sulfate	Spectrophotometric thorin	
Turbidity	Hellige turbidmeter, Nephelometric	Nephelometric introduced after July 1969
Vanadium	Catalytic oxidation	
Zinc	Atomic absorbtion	

Table 5 . Bottom Fauna Sampling Stations on the Kootenai River, 1968 - 1971.

Bottom Sampling Locations

Station 1.	Downstream from the town of Rexford, Montana on the west bank at river kilometer 414.4, 1.6 kilometer upstream from the new reservoir bridge and 57.3 kilometers upstream from Libby Dam.
Station 2.	Near the town of Warland, Montana on the west bank at river kilometer 369.5, 1.6 kilometer upstream from the Warland Bridge and 12.3 kilometers upstream from Libby Dam.
Station 3.	East bank of the river at river kilometer 352.3, 1.1 kilometer upstream of the Highway 37 Bridge and 4.8 kilometers downstream from Libby Dam.
Station 4.	North bank of the river near Lowry Gulch at river kilometer 342.6, 14.5 kilometers below Libby Dam.

Cylindrical Substrate Locations

Station 1.	Bouys attached to the St. Regis Bridge at river kilometer 419.2, 62.1 kilometers upstream from Libby Dam.
Station 2.	Bouys attached to the Warland Bridge at river kilometer 367.9, 10.8 kilometers upstream from Libby Dam.
Station 3.	Bouys anchored in river at river kilometer 351.5, 0.3 kilometer upstream from the Highway 37 Bridge and 5.6 kilometers downstream from Libby Dam.

Table 6 . Discharge of the Kootenai River at Newgate, B.C., 1967-1971

		Calendar Year					
Discharge		1967	1968	1969	1970	1971	1967-71
Total	m^3/sec-day	126751	108834	127547	78441	122355	
	ft^3/sec-day	4476130	3843410	4504250	2770120	4320890	
Mean	m^3/sec	347	297	349	215	335	309
	ft^3/sec	12260	10500	12340	7589	11840	10906
Maximum	m^3/sec	1994	1761	1858	1422	1688	
	ft^3/sec	70400	62200	65600	50200	59600	
Minimum	m^3/sec	46	47	52	37	44	
	ft^3/sec	1620	1670	1820	1290	1570	
Percent 41 yr. mean (1930-71, 298 m^3/sec, 10520 ft^3/sec)		117	100	117	72	113	104

Table 7. Discharge of the Kootenai River Near Rexford, Montana, 1967-1971

Discharge		1967	1968	1969	1970	1971	1967-71
			Calendar Year				
Total	m^3/sec-day		115472	140118	83600		
	ft^3/sec-day		4077820	4948210	2952280		
Mean	m^3/sec		345	384	229		
	ft^3/sec		11140	13560	8088		
Maximum	m^3/sec		1758	1960	1405		
	ft^3/sec		62100	69200	49600		
Minimum	m^3/sec		57	48	37		
	ft^3/sec		2000	1700	1300		
Percent 15-yr. mean (192940, 67-71, 287 m^3/sec 10130 ft^3/sec)			110	134	80		

Table 8. Discharge of the Kootenai River Below Libby Dam, 1967 - 1971.[1]

Discharge		1967	1968	1969	1970	1971	1967-71
				Calendar Year			
Total	m^3/sec-day	139490	117524	141282	86452	137454	
	ft^3/sec-day	4926010	4150290	4989310	3053020	4854120	
Mean	m^3/sec	382	321	387	237	378	341
	ft^3/sec	13500	11340	13670	8364	13299	12043
Maximum	m^3/sec	2078	1753	1954	1424	1863	
	ft^3/sec	73400	61900	69000	50300	65800	
Minimum	m^3/sec	54	51	45	37	45	
	ft^3/sec	1900	1800	1800	1300	1600	
Percent 10-yr. mean (1961-71, 338 m^3/sec, 11920 ft^3/sec)		113	95	115	70	112	102

1. Figures prior to September 1971 were obtained from the stream gage at Warland.

Table 9. Discharge of the Kootenai River near Copeland, Idaho, 1967-1971.

Discharge		1967	1968	1969	1970	1971	1967-71
		Calendar Years					
Total	m^3/sec-day	190079	160270	202491	118790	191435	
	ft^3/sec-day	6712540	5659850	7150880	4194990	6760430	
Mean	m^3/sec	521	438	555	325	524	473
	ft^3/sec	18390	15460	19590	11490	18520	16692
Maximum	m^3/sec	2710	2101	2500	1812	2469	
	ft^3/sec	95700	74200	88300	64000	87200	
Minimum	m^3/sec	85	89	78	72	71	
	ft^3/sec	3000	3150	2770	2560	2500	
Percent 43-yr. mean (1927-72, 446 m^3/sec, 15,750 ft^3/sec)		117	98	124	73	118	106

Table 10. Discharge of the Kootenai River at Porthill, Idaho, 1967-71

Discharge		1967	1968	1969	1970	1971	1967-71
		Calendar Year					
Total	m^3/sec-day	195480	165996	209127	122999	198204	
	ft^3/sec-day	6903290	5862060	7385220	4343650	6999460	
Mean	m^3/sec	535	454	573	337	543	488
	ft^3/sec	18910	16020	20230	11900	19180	17247
Maximum	m^3/sec	2784	2129	2588	1863	2554	
	ft^3/sec	98300	75200	91400	65800	90200	
Minimum	m^3/sec	88	91	79	75	74	
	ft^3/sec	3100	3220	2800	2650	2620	
Percent 44-yr. mean (1928-72, 456 m^3/sec, 16120 ft^3/sec)		117	99	125	74	119	107

Table 11. Monthly Mean Water Temperature in the Kootenai River at Waldo, B.C., 1962 - 1971.

Degrees C

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1962												
1963						9.0			12.8	7.9		
1964						9.2	13.5	13.7	10.4			
1965						10.1	14.6	16.3	10.3	7.7		
1966						10.4	13.7	15.4	14.0	7.8		
1967					7.8	8.1	12.2	14.4	12.8	7.0		
1968					9.7	10.0	13.9	14.9	12.7	7.2		
1969					8.7	10.1	13.2	14.9	12.1	6.1		
1970					10.3	12.0	16.3	16.6	10.9	6.7		
1971					8.9	9.7	12.9	16.2	11.4	7.1		

Table 12. Monthly Mean Water Temperatures in the Elk River at Phillips Bridge, B.C., 1962 - 1971.

Degrees C

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1962												
1963						7.8		12.7	12.1	7.3		
1964						7.8	11.9	11.8	9.0	5.7		
1965						9.6	13.2	14.7	9.9	8.6		
1966							12.8	13.7	12.6	7.1		
1967					6.1	7.7	11.9	13.7				
1968					8.3	10.1	14.0	14.2	12.0	7.3		
1969					6.6	9.1	11.7	13.1	10.3	3.9		
1970					7.3	10.2	13.6	14.3	9.3	6.4		
1971					8.6	10.6	13.5		11.6	7.9		

Table 13. Monthly Mean Water Temperatures in the Kootenai River at Warland, 1962 - 1971

Degrees C

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1962							14.1	14.9	11.7	6.4		
1963				5.8			13.0	16.5	14.3	8.8	3.0	
1964					8.1	8.4	12.8	13.1	10.7	7.8		
1965					8.7			16.6	10.3	7.6		
1966						11.6				9.3		
1967							13.5	16.1	14.1	8.1		
1968				7.6	9.7	10.6	14.4	15.4	12.8	7.2		
1969				7.8	9.7	11.8	14.7	16.7	13.6	7.3		
1970					10.7	12.9	17.3	17.9	11.8	7.0		
1971				7.6	9.1			17.4	12.2	7.4		

Table 14. Monthly Mean Water Temperatures in the Kootenai River below Libby Dam, 1968 - 1971

Degrees C

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1962												
1963												
1964												
1965												
1966												
1967												
1968				8.9	10.9	11.8			14.0	8.3		
1969				8.0	9.9	12.2	15.3	17.2	14.2	8.0		
1970					11.0	12.7	17.8	18.5	12.3	7.8		
1971				7.6	8.3	10.0	14.1	18.1	12.3	7.2		

Table 15. Summary of Monthly Mean Water Temperatures in the Kootenai River at Leonia, 1962 - 1971.

Degrees C

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1962									12.2	7.6	3.8	1.2
1963				6.3		11.8	13.9	16.8	14.6	9.4	3.6	
1964					8.3	10.4	15.3	15.3	11.8	7.6		
1965					9.6	11.5	16.3	18.3	11.8	9.3		
1966						11.6	15.9	17.3	15.8	9.2	4.2	
1967					8.3	10.3		16.9	14.8	8.8		
1968				7.4	9.8	11.2			13.6			
1969				7.6	10.1	12.6	16.1					
1970				6.3	9.2	12.8			11.7			
1971				7.7	9.4	11.0	15.5	19.1	13.5	8.6		

Table 16. Monthly Mean Water Temperatures in the Kootenai River at Porthill, 1962 - 1972

Degrees C

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1962												
1963						11.7	14.4	18.5	16.2	11.6	4.9	0.5
1964	0.0	0.0	2.2	7.2	9.7	11.3	16.2	16.7	12.8	8.7	4.4	0.9
1965	0.0	0.1	2.2	7.5	9.1	11.3	15.6	18.5	11.6	8.5	4.7	1.2
1966	0.7	0.6	2.4	7.1	10.4	11.8	15.8	18.3	16.8	10.7	4.6	2.7
1967	1.1	1.8	2.9	6.6	7.9	10.0	15.4	18.8	17.7	11.8	4.4	0.9
1968	0.0	0.6	4.7	6.7	9.0	10.2	13.7	16.9	15.3	9.3	4.7	1.1
1969	0.0	0.0										
1970				6.8	8.1	13.2	19.0	19.1	14.4	9.4	3.6	0.4
1971	0.0	0.0	2.2		10.0	11.4	15.4	20.1	14.9	9.7	3.8	1.3
1972	0.0	0.0	2.8									

TABLE 17, KOOTENAI RIVER NEAR REXFORD, MONT.

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCEN-TRATION (MG/L)	OCTOBER LOAD (TONS)[1]	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCEN-TRATION (MG/L)	NOVEMBER LOAD (TONS)[1]	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCEN-TRATION (MG/L)	DECEMBER LOAD (TONS)[1]
1	4600	3	37	4620	6	75	3210	5	43
2	4660	7	87	5660	8	120	3300	6	53
3	4710	6	76	5470	9	130	3420	7	65
4	4800	7	91	4930	7	93	3480	5	47
5	4690	5	63	4650	8	100	3450	4	37
6	4660	6	75	4200	9	100	3480	5	47
7	4690	4	51	4080	7	77	3300	7	62
8	4380	2	24	3970	6	64	3160	6	51
9	4300	3	35	3900	6	63	3090	3	25
10	4300	2	23	4320	6	70	3230	4	35
11	4520	4	49	4400	6	71	3400	6	55
12	4690	6	76	4200	7	79	3020	5	41
13	5150	7	97	4400	6	71	2600	4	28
14	5640	20	300	4080	5	55	2100	6	34
15	4970	27	360	4150	5	56	1850	6	30
16	4730	92	1200	4200	14	160	1850	9	45
17	4520	43	520	4240	8	92	2000	7	38
18	4320	10	120	3990	4	43	2100	5	28
19	4240	37	420	3950	4	43	2200	5	30
20	4320	16	190	3810	6	62	2300	3	19
21	4320	3	35	3840	6	62	2400	2	13
22	4360	4	47	3600	6	58	2520	8	54
23	4440	4	48	3600	5	49	2750	13	97
24	4420	6	72	3480	5	47	3230	16	140
25	4300	5	58	3500	6	57	3380	14	130
26	4170	5	56	3560	11	110	3320	10	90
27	4110	3	33	2910	9	71	3360	10	91
28	4200	9	100	2710	5	37	3210	10	87
29	4220	7	80	3070	4	33	3230	28	240
30	4320	5	58	3090	5	42	3140	320	2700
31	4040	6	65	--	--	--	3140	60	510
TOTAL	139730	--	4546	120620	--	2190	90220	--	4965

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCEN-TRATION (MG/L)	JANUARY LOAD (TONS)[1]	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCEN-TRATION (MG/L)	FEBRUARY LOAD (TONS)[1]	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCEN-TRATION (MG/L)	MARCH LOAD (TONS)[1]
1	3100	6	50	2820	20	150	3210	12	100
2	2400	5	32	3130	14	120	3140	9	76
3	2300	4	25	3300	10	89	3240	8	70
4	2400	11	71	3650	24	240	3280	21	150
5	2580	8	56	3830	19	200	3650	25	250
6	2580	6	42	3520	14	130	3810	30	210
7	2590	6	42	3210	9	78	3930	32	340
8	2620	6	42	3090	8	67	3990	17	180
9	2740	7	52	2990	6	48	3990	9	97
10	2800	6	45	2950	5	40	3720	9	90
11	2760	8	60	2860	4	31	3560	7	67
12	2500	6	40	2910	7	55	3340	26	230
13	2500	7	47	2870	5	39	3450	16	150
14	2600	11	77	2780	4	30	3390	9	82
15	2750	7	52	2730	5	37	3440	19	180
16	2900	8	63	2570	7	49	3460	9	84
17	3000	7	57	2590	6	42	3620	15	150
18	2900	7	55	2640	3	21	3990	15	150
19	3020	7	57	2710	4	29	3540	7	67
20	3070	8	66	2910	6	47	3420	7	65
21	3280	12	110	2970	12	96	3320	7	63
22	3500	12	110	3030	17	140	3230	8	70
23	3500	16	150	3030	15	120	3480	30	280
24	3570	11	110	3270	51	490	3520	11	100
25	3540	10	96	3750	27	270	3570	14	130
26	3110	12	100	3240	11	96	3570	13	130
27	2460	7	46	3210	10	87	3570	7	67
28	2000	5	27	3140	9	76	3760	14	140
29	2200	9	53	3130	12	100	3780	18	180
30	2510	16	110	--	--	--	3930	20	210
31	2690	15	110	--	--	--	4000	22	240
TOTAL	86430	--	2053	88830	--	2977	110500	--	4530

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCENTRATION (MG/L)	APRIL LOAD (TONS)[1]	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCENTRATION (MG/L)	MAY LOAD (TONS)[1]	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCENTRATION (MG/L)	JUNE LOAD (TONS)[1]
1	3860	11	110	8500	140	3200	34800	70	6600
2	3860	11	110	10600	130	3700	34200	80	7400
3	3640	7	69	10000	46	1200	50000	610	82000
4	3570	5	48	10100	39	1100	62100	870	150000
5	3560	8	77	10500	47	1300	59800	550	89000
6	3590	6	58	11500	15	470	49600	320	43000
7	3570	6	58	10900	31	910	43400	170	20000
8	3480	5	47	10100	22	600	43500	120	14000
9	3390	5	46	9470	20	510	43600	120	14000
10	3380	6	55	9470	18	460	45700	130	16000
11	3450	6	56	10200	25	690	48200	150	20000
12	3800	12	120	11800	43	1400	50200	160	22000
13	3570	13	140	15000	82	3300	50400	160	22000
14	4000	12	130	19000	190	9700	45200	140	17000
15	4020	11	120	22500	200	12000	38400	97	10000
16	3880	9	94	21200	100	5700	33200	88	7900
17	3780	9	92	20200	70	3800	30900	72	6000
18	3600	7	68	21500	78	4500	31600	80	6800
19	3640	4	39	24200	160	10000	35100	83	7900
20	3760	6	61	27100	180	13000	42300	150	17000
21	3650	5	49	30400	210	17000	47600	210	27000
22	3510	7	66	34800	320	30000	42300	130	15000
23	3450	6	56	42000	420	48000	37500	82	8300
24	3510	6	57	43400	340	40000	35400	70	6700
25	3510	4	38	40900	190	21000	33800	54	4900
26	3600	3	29	35800	120	12000	34500	57	5300
27	3800	7	72	36000	100	9700	39500	110	12000
28	3800	6	62	35300	92	8800	45200	200	24000
29	3970	6	64	36400	100	9800	40900	140	15000
30	5170	27	380	37700	120	12000	33800	83	7600
31	--	--	--	37400	92	9300	--	--	--
TOTAL	111790	--	2471	703940	--	295140	1262700	--	704400

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCENTRATION (MG/L)	JULY LOAD (TONS)[1]	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCENTRATION (MG/L)	AUGUST LOAD (TONS)[1]	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCENTRATION (MG/L)	SEPTEMBER LOAD (TONS)[1]
1	28400	60	4600	13000	18	630	7840	8	170
2	27900	58	4400	12200	13	430	7790	10	210
3	26500	67	4800	11800	10	320	7790	8	170
4	30100	67	5400	11800	10	320	7590	9	180
5	31900	84	7200	11700	10	320	7310	11	220
6	33500	94	8500	11700	10	320	7060	8	150
7	36200	98	9600	11700	14	440	6860	9	170
8	36700	96	9500	11200	40	1200	7090	6	110
9	34800	76	7100	10400	18	510	7420	8	160
10	32800	60	5300	9820	10	270	7200	5	97
11	31600	56	4800	9440	10	250	6840	5	92
12	29000	66	5200	9400	17	430	6840	10	180
13	28300	81	6200	9400	14	360	6750	6	110
14	27000	63	4600	9220	10	250	6570	4	71
15	23100	48	3000	9280	10	250	6890	8	150
16	20100	54	2900	10100	10	270	6780	12	220
17	18800	46	2300	10900	12	350	6700	6	110
18	17600	43	2000	9860	22	590	7000	7	130
19	16300	34	1500	9540	10	260	8230	12	270
20	16300	25	1100	9220	8	200	8680	13	300
21	17400	28	1300	9010	6	150	8440	10	230
22	18700	33	1700	9040	5	120	8080	6	130
23	17400	32	1500	8950	6	140	7820	9	190
24	16500	38	1700	8440	5	110	7590	7	140
25	16500	21	940	8260	11	250	7540	6	120
26	15400	32	1300	7930	8	170	7480	15	300
27	14700	17	670	8410	7	160	7650	11	230
28	14300	20	770	8680	9	210	8080	10	220
29	14200	14	540	8980	9	220	8470	9	210
30	14200	18	690	8650	8	190	8290	6	130
31	13800	13	480	8170	7	150	--	--	--
TOTAL	720000	--	111590	306200	--	9840	224670	--	5170

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 3965630
TOTAL LOAD FOR YEAR (TONS) 1149800

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCEN-TRATION (MG/L)	OCTOBER LOAD (TONS)[1]	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCEN-TRATION (MG/L)	NOVEMBER LOAD (TONS)[1]	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCEN-TRATION (MG/L)	DECEMBER LOAD (TONS)[1]
1	7990	9	194	6470	7	122	4110	4	44
2	7760	5	105	6420	5	87	4060	4	44
3	7480	5	101	6260	6	101	4110	5	55
4	7340	7	139	6130	8	132	4220	6	68
5	7120	5	96	5950	8	129	4220	5	57
6	7090	5	96	5740	6	93	3810	12	123
7	6950	5	94	5620	5	76	3260	31	273
8	6750	4	73	5330	4	58	3420	14	129
9	6490	3	53	5130	6	83	3800	8	82
10	6310	4	68	5080	6	82	3830	6	62
11	6550	4	71	5080	5	69	4380	7	83
12	6730	5	91	5300	7	100	4360	7	82
13	6980	4	75	5520	6	89	3800	12	123
14	6920	5	93	5240	6	85	3500	13	123
15	6730	12	218	5040	5	68	3640	8	79
16	6550	6	106	5020	14	190	3880	6	63
17	6230	9	151	4690	8	101	4080	7	77
18	5980	13	210	4690	4	51	4080	9	99
19	5780	6	94	4580	10	124	4060	13	143
20	5830	4	63	4580	23	284	3400	7	64
21	5780	3	47	4710	16	203	3210	6	52
22	5640	3	46	4840	5	65	2840	6	46
23	5520	4	60	5080	6	82	2960	4	32
24	5380	5	73	4970	5	67	2840	4	31
25	5380	4	58	4930	5	67	3040	5	41
26	5640	4	61	4640	5	63	3260	7	62
27	6130	5	83	4460	4	48	2840	8	61
28	6210	6	101	4240	4	46	2600	13	91
29	6080	3	49	4240	3	34	2400	23	149
30	6130	4	66	4170	4	45	2300	13	81
31	6650	6	108	--	--	--	2200	5	30
TOTAL	200100	--	2943	154150	--	2844	108510	--	2549

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCEN-TRATION (MG/L)	JANUARY LOAD (TONS)[1]	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCEN-TRATION (MG/L)	FEBRUARY LOAD (TONS)	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCEN-TRATION (MG/L)	MARCH LOAD (TONS)
1	2400	9	58	2700	5	36	2750	13	97
2	2600	8	56	2700	4	29	2740	9	67
3	2800	8	60	2800	5	38	2740	10	74
4	3000	13	105	2900	6	47	2710	6	44
5	3200	18	156	3000	5	40	2730	10	74
6	3300	20	178	2900	6	47	2790	7	53
7	3400	12	110	2800	9	68	2820	5	38
8	3500	10	94	2700	9	66	2640	7	50
9	3600	13	126	2600	13	91	2640	7	50
10	3500	15	142	2500	11	74	2650	5	36
11	3400	15	138	2500	15	101	2650	5	36
12	3300	13	116	2600	13	91	2650	7	50
13	3200	15	130	2600	11	77	2660	9	65
14	3200	11	95	2600	12	84	2760	17	127
15	3300	10	89	2700	16	117	2760	7	52
16	3500	9	85	2700	15	109	2750	6	45
17	3600	11	107	2600	13	91	2990	14	113
18	3600	21	204	2600	11	77	3270	16	141
19	3500	9	85	2500	10	68	3460	5	47
20	3300	3	27	2400	13	84	3460	15	140
21	3100	2	17	2500	12	81	3360	21	191
22	3000	1	8.1	2600	13	91	3360	14	127
23	2900	1	7.8	2730	10	74	3380	10	91
24	2900	1	7.8	2730	8	59	3270	21	185
25	3000	1	8.1	2730	9	66	3260	17	150
26	3100	3	25	2760	7	52	3230	18	157
27	3200	10	86	2750	9	67	3230	9	78
28	3100	2	17	2750	7	52	3390	11	101
29	3000	3	24	--	--	--	3640	14	138
30	2800	5	38	--	--	--	3480	18	169
31	2700	7	51	--	--	--	4000	23	248
TOTAL	98000	--	2450.8	74950	--	1977	94220	--	3034

TABLE 17.7 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	4580	28	346	19800	57	3050	46500	138	17300
2	4990	34	458	18100	42	2050	44300	119	14200
3	5190	37	518	17200	31	1440	48100	156	20300
4	5330	39	561	16700	30	1350	56100	300	45400
5	5400	30	437	16200	25	1090	63400	378	64700
6	5950	42	675	16300	25	1100	67900	487	89300
7	7120	65	1250	18400	37	1840	69200	458	85600
8	8410	82	1860	22400	69	4170	65200	294	51800
9	9250	70	1750	25300	96	6560	57300	245	37900
10	10400	71	1990	30600	199	16400	51900	200	28000
11	11000	77	2290	38500	370	38500	50900	147	20200
12	11800	71	2260	47100	439	55800	49900	112	15100
13	12800	66	2280	52700	535	76100	46700	109	13700
14	13500	49	1790	52200	537	75700	41700	98	11000
15	13500	47	1710	57800	490	76500	36100	94	9160
16	13400	43	1560	53900	325	47300	32600	76	6690
17	13600	46	1690	46700	200	25200	31500	75	6380
18	15500	77	3220	41800	131	14800	32100	66	5720
19	17700	110	5260	39000	104	11000	33900	69	6320
20	17000	65	2980	38500	88	9150	37900	137	14000
21	15000	45	1820	37600	76	7700	44200	137	16300
22	13900	37	1390	37300	65	6550	48500	184	24100
23	14800	55	2200	40000	79	8530	46200	91	11400
24	23000	232	14400	46100	88	11000	43400	98	11500
25	31300	327	27600	53100	280	40100	42600	98	11300
26	28200	178	13600	59800	463	74800	46900	108	13700
27	23300	107	6730	63400	525	89900	48100	129	16800
28	21000	63	3570	59100	314	50100	48700	139	18300
29	19400	50	2620	50900	208	28600	48600	120	15700
30	20400	55	3030	48100	177	23000	47000	88	11200
31	--	--	--	50100	218	29500	--	--	--
TOTAL	416720	--	111845	1214700	--	838880	1427400	--	713070

TABLE 17.8 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	43200	85	9910	13200	15	535	6340	5	86
2	40500	76	8310	12700	11	377	6260	5	85
3	38900	61	6410	12300	10	322	6110	6	99
4	39200	67	7090	12000	9	292	5890	8	127
5	38400	65	6740	11400	8	246	5800	7	110
6	36700	72	7130	11400	7	215	5780	5	78
7	34000	49	4500	11500	9	279	5700	8	123
8	32800	93	8240	11000	9	267	5700	7	108
9	30600	86	7110	10600	9	258	5300	8	114
10	29700	57	4570	10300	9	250	5300	5	72
11	29100	41	3220	9920	8	214	5300	3	43
12	27900	39	2940	9800	8	212	5150	5	70
13	26800	35	2530	9650	8	208	5150	7	97
14	24500	39	2580	9230	8	199	5180	5	70
15	23000	43	2670	8970	7	170	5560	4	60
16	21300	40	2300	8680	5	117	5700	5	77
17	20000	29	1570	8680	8	187	5430	4	59
18	19200	35	1810	8680	8	187	5300	4	57
19	18600	27	1360	8390	7	159	5300	5	72
20	18200	31	1520	7980	6	129	5300	6	86
21	17900	16	773	7780	7	147	5720	6	93
22	17800	10	481	7640	7	144	5910	8	128
23	17500	18	850	7580	5	102	5910	9	144
24	17400	18	846	7580	7	143	6550	11	195
25	17200	13	604	7480	9	182	6850	14	259
26	17200	15	697	7480	8	162	6790	14	257
27	16600	14	627	7640	9	186	6700	12	217
28	15700	12	509	7480	9	182	6400	8	138
29	15000	13	527	7320	5	99	6000	7	113
30	14400	13	505	7160	5	97	6400	7	121
31	13800	17	633	6700	7	127	--	--	--
TOTAL	773100	--	99562	288220	--	6394	174780	--	3398

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 5024850
TOTAL LOAD FOR YEAR (TONS) 1788906.8

TABLE 17.9 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCENTRATION (MG/L)	OCTOBER SEDIMENT DISCHARGE (TONS/DAY)[1]	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCENTRATION (MG/L)	NOVEMBER SEDIMENT DISCHARGE (TONS/DAY)[1]	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCENTRATION (MG/L)	DECEMBER SEDIMENT DISCHARGE (TONS/DAY)[1]
1	7880	15	319	3930	4	42	2970	6	48
2	8750	29	685	4030	6	65	3090	10	83
3	8390	14	317	4130	4	45	3180	5	43
4	7950	7	150	4190	3	34	3000	6	49
5	7130	8	154	4130	5	56	2950	5	40
6	6820	6	110	4490	6	73	2950	5	40
7	6110	5	82	5000	5	68	2950	6	48
8	6260	4	68	5080	10	137	2990	5	40
9	6880	4	74	4510	8	97	3020	6	49
10	6230	4	67	4700	7	89	3020	4	33
11	5970	2	32	4210	10	114	2960	6	48
12	5860	8	127	4340	4	47	2960	3	24
13	5400	6	87	4450	2	24	3240	4	35
14	5400	2	29	4450	3	36	3310	6	54
15	5050	2	27	4170	6	68	3310	6	54
16	5030	2	27	3950	3	32	3560	4	38
17	4910	1	13	4030	3	33	3630	5	49
18	4810	4	52	4130	5	56	3650	5	49
19	4790	5	65	4210	3	34	3390	7	64
20	4670	18	227	4130	4	45	3240	7	61
21	4400	12	143	4130	5	56	3310	6	54
22	4400	4	48	3560	5	48	3310	8	71
23	4030	2	22	3710	3	30	3310	7	63
24	4260	2	23	3910	3	32	3330	6	54
25	4810	2	26	4010	1	11	3160	6	51
26	4670	4	50	3390	3	27	2880	4	31
27	4560	4	49	3310	4	36	2880	4	31
28	4130	2	22	3240	4	35	1800	6	29
29	4150	2	22	3020	8	65	1700	3	14
30	4030	4	44	2950	6	48	1700	3	14
31	4450	4	48	--	--	--	1700	5	23
TOTAL	172180	--	3209	121490	--	1583	92450	--	1384

TABLE 17.10 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCENTRATION (MG/L)	JANUARY SEDIMENT DISCHARGE (TONS/DAY)[1]	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCENTRATION (MG/L)	FEBRUARY SEDIMENT DISCHARGE (TONS/DAY)[1]	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCENTRATION (MG/L)	MARCH SEDIMENT DISCHARGE (TONS/DAY)[1]
1	1700	5	23	2760	6	45	2460	6	40
2	1700	4	18	2620	7	50	2430	5	33
3	1600	4	17	2700	11	80	2400	6	35
4	1500	4	16	2640	6	43	2350	5	32
5	1300	4	14	2700	7	51	2370	4	26
6	1400	4	15	2700	6	44	2350	5	32
7	1500	8	32	2700	8	58	2620	6	42
8	1600	5	22	2700	6	44	2640	7	50
9	1700	6	28	2700	5	36	2640	8	57
10	1800	10	49	2700	5	36	2660	11	79
11	1900	18	92	2700	5	36	2660	7	50
12	2100	13	74	2700	8	58	2830	15	115
13	2200	16	95	2700	16	117	2960	10	80
14	2300	18	112	2640	8	57	3000	5	41
15	2400	12	78	2640	11	78	3000	6	49
16	2400	12	78	2830	7	53	3000	12	97
17	2300	15	93	2870	8	62	2880	6	47
18	2100	11	62	2870	10	77	2880	6	47
19	2300	8	50	2860	11	85	2910	8	63
20	2900	5	34	2860	16	124	2920	8	63
21	2700	6	44	2900	7	55	2920	6	47
22	2900	10	78	2900	8	63	2700	3	22
23	3000	13	105	2760	7	52	2640	2	14
24	3100	13	109	2640	3	21	2640	7	50
25	3200	11	95	2570	2	14	2640	8	57
26	3200	9	78	2500	6	41	2640	12	86
27	3100	12	100	2500	9	61	2640	10	71
28	2960	8	64	2500	6	41	2700	6	44
29	2760	5	37	--	--	--	2700	7	51
30	2760	5	37	--	--	--	2700	4	29
31	2760	5	37	--	--	--	2700	2	15
TOTAL	70740	--	1786	75060	--	1582	83580	--	1568

TABLE 17.11 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	2790	2	15	3360	10	91	23600	67	4270
2	2790	9	68	3440	13	121	25800	87	6060
3	2790	5	38	4090	38	420	31900	138	11900
4	2790	3	23	5470	50	738	40200	183	19900
5	2790	5	38	7420	128	2560	47600	222	28500
6	2910	4	31	10400	130	3650	49600	223	29900
7	3240	3	26	14000	132	4990	48800	142	18700
8	3590	6	58	16300	130	5720	46800	72	9100
9	3510	6	57	16400	85	3760	44400	56	6710
10	3510	6	57	15900	41	1760	42300	34	3880
11	3670	5	50	15000	24	972	37100	31	3110
12	3670	5	50	14100	20	761	30400	29	2380
13	3560	6	58	12600	20	680	26000	25	1760
14	3390	5	46	11300	20	610	25200	22	1500
15	3240	4	35	10500	20	567	26900	28	2030
16	3210	6	52	11000	24	713	29600	94	7510
17	3180	8	69	15300	67	2770	34300	128	11900
18	3140	5	42	22900	146	9030	35900	133	12900
19	3170	8	68	24800	190	12700	34500	97	9040
20	3240	6	52	24700	218	14500	33800	69	6300
21	3390	4	37	24500	78	5160	32700	54	4770
22	3500	5	47	25300	148	10100	31600	48	4100
23	3510	7	66	26800	167	12100	30600	64	5290
24	3510	4	38	28200	154	11700	28400	62	4750
25	3540	7	67	29800	150	12100	24900	40	2690
26	3590	12	116	33500	132	11900	23300	24	1510
27	3590	11	107	38500	89	9250	21800	23	1350
28	3560	4	38	34900	79	7440	21700	24	1410
29	3400	5	46	29800	77	6200	22000	22	1310
30	3360	8	73	26300	78	5540	21400	35	2020
31	--	--	--	24400	68	4480	--	--	--
TOTAL	99130	--	1568	580980	--	163083	973100	--	226550

TABLE 17.12 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	21000	32	1810	9100	8	197	4990	9	121
2	19700	29	1540	8800	8	190	4970	17	228
3	18300	25	1240	8380	6	136	5210	28	394
4	17400	20	940	8140	6	132	5450	14	206
5	17700	22	1050	7990	8	173	5400	9	131
6	17800	23	1110	8260	7	156	5210	7	98
7	17000	16	734	7840	7	148	5100	10	138
8	15600	13	548	7650	9	186	5190	8	112
9	14800	11	440	7650	8	165	5400	8	117
10	14800	10	400	7400	9	180	5130	9	125
11	14200	12	460	6810	12	221	5080	7	96
12	13600	13	477	6550	11	195	4880	6	79
13	12600	14	476	6420	9	156	4860	14	184
14	12200	12	395	6360	11	189	4640	5	63
15	11200	10	302	6340	14	240	4520	6	73
16	10600	11	315	6130	16	265	4480	5	60
17	10600	13	372	5780	12	187	4320	6	70
18	10500	12	340	5810	8	125	4280	5	58
19	10600	11	315	5780	10	156	4580	5	62
20	9960	12	323	5570	8	120	5950	8	129
21	9650	10	261	5350	5	72	6080	11	181
22	9680	7	183	5300	13	186	5900	8	127
23	9790	6	159	5240	10	141	5880	10	159
24	9370	9	228	5240	4	57	5880	9	143
25	8860	9	215	5300	5	72	5660	10	153
26	8710	10	235	5210	5	70	5350	6	87
27	8860	8	191	5170	6	84	5150	14	195
28	9130	11	271	5080	6	82	5080	6	82
29	9790	9	238	5130	13	180	4950	7	94
30	9790	15	396	5170	10	140	4910	5	66
31	9280	10	251	5130	4	55	--	--	--
TOTAL	393070	--	16215	200080	--	4656	154480	--	3831

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 3017140
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 427015

TABLE 17.13 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	4910	2	27	3600	2	19	2800	7	53
2	4910	4	53	3650	4	39	2880	5	35
3	4860	4	52	3600	2	19	2880	2	16
4	4770	6	77	3620	2	20	2880	6	47
5	4770	4	52	3480	2	19	2900	3	23
6	4880	6	79	3560	2	19	2900	2	16
7	5080	5	69	3620	2	20	3360	9	82
8	5130	5	69	3640	2	20	3780	7	71
9	5020	4	54	3670	2	20	3670	26	258
10	4880	3	40	3730	4	40	3400	14	129
11	4710	4	51	3680	2	20	3200	7	60
12	4580	4	49	3670	2	20	3000	6	49
13	4580	4	49	3620	2	20	2800	6	45
14	4420	4	48	3570	5	48	2700	8	58
15	4320	4	47	3510	7	66	2900	7	55
16	4220	8	91	3510	8	76	3000	7	57
17	4220	3	34	3460	3	28	3100	8	67
18	4180	6	68	3420	5	46	3200	9	78
19	4000	4	43	3420	7	65	3100	7	59
20	4060	6	66	3420	5	46	3000	6	49
21	4080	6	66	3400	45	413	2700	5	36
22	4090	5	55	2500	23	155	2300	7	43
23	3910	5	53	2000	23	124	1800	9	44
24	4110	6	67	2200	24	143	1400	18	68
25	4110	4	44	2820	7	53	1800	20	97
26	4110	4	44	2820	5	38	2100	10	57
27	4000	4	43	2820	4	30	2400	12	78
28	3910	4	42	2750	8	59	2600	15	105
29	3670	5	50	2680	10	72	2800	16	121
30	3600	7	68	2780	9	68	3000	10	81
31	3600	5	49	--	--	--	3000	6	49
TOTAL	135690	--	1699	98220	--	1825	87350	--	2090

TABLE 17.14 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	3000	15	122	4100	17	188	3020	7	57
2	2500	14	95	4600	7	87	3020	7	57
3	2000	10	54	4620	4	50	2860	6	46
4	1800	9	44	4620	7	87	2820	7	53
5	1700	12	55	4500	3	36	2840	6	46
6	1600	23	99	4000	10	108	2760	6	45
7	1900	12	62	3500	14	132	2830	8	61
8	2000	7	38	3000	19	154	2840	6	46
9	2100	7	40	3200	13	112	2840	6	46
10	2000	9	49	3400	6	55	2880	7	54
11	1900	10	51	3600	10	97	2910	8	62
12	1800	8	39	3800	24	246	2910	8	63
13	1900	6	31	4000	16	173	2910	8	63
14	2000	5	27	4200	16	181	2880	7	54
15	2100	7	40	4060	19	208	2860	9	69
16	2200	7	42	4020	11	119	2780	8	60
17	2400	12	78	3900	11	116	2800	9	68
18	2700	7	51	3720	20	201	2750	10	74
19	3000	4	32	3420	17	157	2730	12	88
20	3500	8	76	3380	10	91	2730	6	44
21	3800	83	852	3380	7	64	2710	6	44
22	3800	137	1410	3380	6	55	2700	6	44
23	3500	47	444	3300	6	53	2680	11	80
24	3200	22	190	3240	7	61	2700	14	102
25	3200	21	181	3300	7	62	2730	11	81
26	3300	18	160	3210	7	61	2790	9	68
27	3400	18	165	3110	6	50	2830	11	84
28	3500	25	236	3020	9	73	2820	12	91
29	3700	18	180	--	--	--	2800	13	98
30	4020	8	87	--	--	--	2920	28	221
31	3680	17	169	--	--	--	3020	14	114
TOTAL	83200	--	5199	103580	--	3077	87670	--	2184

TABLE 17.15 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCEN-TRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)[1]	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCEN-TRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)[1]	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCEN-TRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)[1]
1	3040	16	131	13500	50	1820	56900	206	31600
2	3000	17	138	14900	49	1970	52600	183	26000
3	2950	15	119	18500	128	6390	52600	171	24300
4	2910	59	464	24800	267	17900	54200	270	39500
5	2960	7	56	31700	366	31300	57500	245	38000
6	3210	32	277	36000	362	35200	60700	256	42000
7	3330	120	1080	36700	239	23700	61400	304	50400
8	3760	24	244	35600	229	22000	62500	285	48100
9	4150	33	370	37000	233	23300	63100	243	41400
10	4800	61	791	39200	212	22400	57100	218	33600
11	4970	31	416	40100	213	23100	51100	170	23500
12	4770	36	464	42900	344	39800	45500	169	20800
13	4500	26	316	50200	351	47600	45000	158	19200
14	4440	19	228	56600	616	94100	48100	169	21900
15	4820	27	351	51500	338	47000	47300	132	16900
16	5380	35	508	43600	208	24500	42400	124	14200
17	5500	32	475	36700	150	14900	38000	120	12300
18	5390	37	537	31200	99	8340	35800	106	10200
19	5210	23	324	28000	65	4910	34300	83	7690
20	5500	25	371	26700	52	3750	34500	73	6800
21	6420	49	849	26000	61	4280	37100	101	10100
22	7680	109	2260	25500	55	3790	41900	160	18100
23	9070	118	2890	26700	86	6200	47900	205	26500
24	11300	89	2720	30100	130	10600	52900	299	42700
25	14400	133	5170	36600	165	16300	54300	207	30300
26	16700	198	8930	45400	284	34800	52100	212	29800
27	16100	186	8090	53100	422	60500	46100	199	24800
28	14800	73	2920	63100	589	100000	39300	140	14900
29	13800	44	1640	65800	597	106000	34500	95	8850
30	13300	40	1440	62000	315	52700	32400	92	8050
31	--	--	--	59000	257	40900	--	--	--
TOTAL	208150	--	44569	1188700	--	930050	1439100	--	742490

TABLE 17.16 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCEN-TRATION (MG/L)	JULY SEDIMENT DISCHARGE (TONS/DAY)[1]	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCEN-TRATION (MG/L)	AUGUST SEDIMENT DISCHARGE (TONS/DAY)[1]	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCEN-TRATION (MG/L)	SEPTEMBER SEDIMENT DISCHARGE (TONS/DAY)[1]
1	31700	81	6930	18300	19	939	8230	16	356
2	31700	64	5480	18300	19	939	8620	16	372
3	31500	58	4930	18300	18	889	8900	20	475
4	29700	46	3690	18100	20	977	8470	11	252
5	28200	48	3650	17300	20	934	7870	10	212
6	26700	56	4040	16300	27	1190	7510	12	243
7	25300	58	3960	15700	24	1020	7310	9	178
8	23100	53	3310	15100	15	612	7480	8	162
9	21200	50	2860	14700	18	714	8110	9	197
10	25400	65	4460	14200	15	575	7680	8	166
11	30100	101	8210	13900	9	338	7400	7	140
12	29100	99	7780	13000	18	632	7030	6	114
13	28000	71	5370	12500	16	540	6950	7	131
14	26900	49	3560	11900	16	514	6950	7	131
15	26100	29	2040	11500	17	528	6600	7	125
16	27200	28	2060	10900	18	530	6340	7	120
17	28700	33	2560	10300	15	417	5900	7	112
18	29300	37	2930	9780	14	370	5830	5	79
19	28500	35	2690	9340	16	403	5710	5	77
20	29500	32	2550	8950	11	266	5660	6	92
21	30000	31	2510	8440	9	205	5590	6	91
22	29900	35	2830	8440	12	273	5470	5	74
23	28800	38	2950	8560	13	300	5300	5	72
24	28200	31	2360	8680	18	422	5150	5	70
25	25100	28	1900	8500	12	275	5060	5	68
26	22900	23	1420	8140	10	220	5060	4	55
27	21400	20	1160	7930	11	236	4990	5	67
28	20400	19	1050	7310	9	178	4990	6	81
29	20000	18	972	7400	9	180	5080	5	69
30	18900	17	868	7590	10	205	4930	4	53
31	18100	14	684	7790	16	337	--	--	--
TOTAL	821600	--	101764	367150	--	16158	196070	--	4424

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 4816480
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 1855539

KOOTENAI RIVER BELOW LIBBY DAM, NEAR LIBBY, MONT

TABLE 18.1

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	4920	15	199	4590	12	149	3230	43	375
2	4920	17	226	5090	12	165	3310	35	313
3	5160	23	320	5780	20	312	3370	22	200
4	5190	72	1010	5600	11	166	3490	18	170
5	5160	65	906	5120	4	55	3600	23	224
6	5060	67	915	4720	6	76	3540	24	229
7	4920	28	372	4330	10	117	3490	14	132
8	4790	15	194	4080	6	66	3290	7	62
9	4720	27	344	4210	5	57	3010	6	49
10	4660	32	403	4300	14	163	2960	6	48
11	4790	32	414	4460	10	120	3200	9	78
12	4920	22	292	4560	6	74	3340	8	72
13	5260	22	312	4430	10	120	2650	7	50
14	5710	15	231	4270	8	92	2200	8	48
15	5600	8	121	4180	7	79	1950	11	58
16	5260	13	185	4150	7	78	1900	16	82
17	5020	73	989	4210	6	68	2000	11	59
18	4850	120	1570	4150	8	90	2150	6	35
19	4760	50	643	4080	4	44	2250	8	49
20	4690	42	532	4020	4	43	2350	8	51
21	4660	51	642	3990	4	43	2450	8	53
22	4620	23	287	3840	6	62	2550	10	69
23	4820	13	169	3780	9	92	2650	21	150
24	4850	11	144	3780	9	92	2750	19	141
25	4820	14	182	3720	9	90	2850	22	169
26	4690	18	228	3600	9	87	3350	20	181
27	4590	18	223	3340	8	72	3450	14	130
28	4660	21	264	3060	36	297	3400	17	156
29	4690	18	228	2790	53	399	3350	18	163
30	4720	7	89	3040	41	337	3200	48	415
31	4660	11	138	--	--	--	3050	58	478
TOTAL	152140	--	12772	125270	--	3705	90330	--	4489

TABLE 18.2

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	2900	17	133	3350	28	253	3150	18	153
2	2500	6	41	3150	32	272	3170	16	137
3	2350	17	108	3550	27	259	3230	13	113
4	2450	19	126	3850	37	385	3400	16	147
5	2850	8	62	4200	24	272	3690	17	169
6	2900	11	86	4200	27	306	3990	19	205
7	2900	8	63	3900	27	284	4330	23	269
8	2950	7	56	3500	16	151	4370	33	389
9	2900	17	133	3250	11	97	4210	24	273
10	3000	21	170	3100	9	75	3960	12	128
11	2900	27	211	2950	8	64	3810	10	103
12	2600	13	91	2950	8	64	3690	11	110
13	2550	6	41	2900	9	70	3540	8	76
14	2750	12	89	2750	7	52	3540	10	96
15	2950	19	151	2750	7	52	3540	8	76
16	3100	24	201	2650	7	50	3520	8	76
17	3100	23	193	2600	7	49	3660	8	79
18	3000	11	89	2600	8	56	3840	6	62
19	3000	11	89	2800	11	83	3750	9	91
20	2950	10	80	3000	13	105	3630	9	88
21	3300	34	303	3100	13	109	3540	8	76
22	3900	35	369	3200	17	147	3460	8	75
23	4150	25	280	3400	32	294	3430	7	65
24	4100	28	310	3500	36	340	3520	8	76
25	4250	17	195	3720	44	442	3630	7	69
26	4350	110	1290	3430	52	482	3840	8	83
27	3200	230	1990	3310	33	295	3840	11	114
28	2250	42	255	3260	18	158	3900	11	116
29	2950	13	104	3170	15	128	4120	10	111
30	3100	12	100	--	--	--	4330	11	129
31	3250	14	123	--	--	--	4430	11	132
TOTAL	95400	--	7532	94090	--	5394	116060	--	3886

TABLE 18.3

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCEN-TRATION (MG/L)	APRIL LOAD (TONS)[1]	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCEN-TRATION (MG/L)	MAY LOAD (TONS)[1]	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCEN-TRATION (MG/L)	JUNE LOAD (TONS)[1]
1	4270	11	127	8900	150	3600	36400	480	47200
2	4120	8	89	11700	180	5690	34800	700	65800
3	3900	9	95	11400	83	2550	45800	800	98900
4	3750	8	81	11300	63	1920	61000	1100	181000
5	3690	6	60	11900	47	1510	61900	1200	201000
6	3690	7	70	12600	38	1290	52000	500	70200
7	3660	8	79	12200	37	1220	46500	170	21300
8	3630	5	49	11400	38	1170	44500	150	18000
9	3570	7	67	10800	42	1220	44400	130	15600
10	3570	7	67	10600	38	1090	45800	170	21000
11	3630	13	127	11400	34	1050	47700	240	30900
12	3960	8	86	12900	42	1460	49500	230	30700
13	4300	1	12	15400	200	8320	50400	240	32700
14	4300	8	93	18600	280	14100	46700	200	25200
15	4300	6	70	22600	320	19500	39600	120	12800
16	4240	9	103	22400	190	11500	34200	86	7940
17	4080	7	77	20900	160	9030	31000	73	6110
18	3870	7	73	22000	190	11300	31100	78	6550
19	3870	6	63	24300	260	17100	33600	100	9070
20	3870	6	63	27200	240	17600	39200	88	9310
21	3840	7	73	30800	240	20000	45500	85	10400
22	3750	7	71	35300	360	34300	42700	80	9220
23	3720	8	80	42800	560	64700	37600	75	7610
24	3690	8	80	45200	430	52500	35100	110	10400
25	3720	8	80	41300	210	23400	33900	85	7780
26	3780	9	92	38100	160	16500	33900	140	12800
27	3870	10	104	37200	120	12100	37600	73	7410
28	3960	12	128	37200	110	11000	43700	66	7790
29	4300	14	163	37600	110	11200	42400	72	8240
30	5460	33	486	38900	110	11600	35200	66	6270
31	--	--	--	38800	110	11500	--	--	--
TOTAL	118360	--	2908	733700	--	401020	1263700	--	999200

TABLE 18.4

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCEN-TRATION (MG/L)	JULY LOAD (TONS)[1]	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCEN-TRATION (MG/L)	AUGUST LOAD (TONS)[1]	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCEN-TRATION (MG/L)	SEPTEMBER LOAD (TONS)[1]
1	29700	62	4970	13400	11	398	7760	8	168
2	26400	64	4560	12500	17	574	7640	5	103
3	25400	110	7540	11900	26	835	7680	6	124
4	27400	110	8140	11800	27	860	7600	6	123
5	30300	110	9000	11700	25	790	7320	3	59
6	32800	110	9740	11800	27	860	7080	7	134
7	34800	100	9400	11800	28	892	6970	6	113
8	36000	87	8460	11400	29	893	6780	7	128
9	34800	91	8550	10800	21	612	7080	7	134
10	32600	58	5110	10200	12	330	7400	8	160
11	31300	40	3380	9690	9	235	7080	8	153
12	29000	40	3130	9510	10	257	6850	8	148
13	27600	40	2980	9420	9	229	6660	7	126
14	27200	40	2940	9340	8	202	6780	7	128
15	23600	39	2490	9200	10	248	6890	13	242
16	20500	40	2210	9650	9	234	6890	9	167
17	18900	78	3980	10500	9	255	6780	9	165
18	17900	67	3240	10400	7	197	6970	5	94
19	16900	34	1550	9690	8	209	7800	7	147
20	16100	34	1480	9340	6	151	8590	7	162
21	16900	32	1460	9120	9	222	8590	6	139
22	18100	21	1030	9200	10	248	8380	7	158
23	17500	16	756	9070	7	171	8050	6	130
24	16700	48	2160	8720	8	188	7680	7	145
25	16400	27	1200	8340	8	180	7640	7	144
26	15700	18	763	7920	10	214	7680	10	207
27	15000	17	689	8090	9	197	7720	11	229
28	14500	16	626	8300	8	179	8050	11	239
29	14200	16	613	8590	8	186	8680	11	258
30	14100	12	457	8680	5	117	8510	10	230
31	14100	10	381	8170	6	132	--	--	--
TOTAL	712400	--	112985	308240	--	11295	225580	--	4657

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 4035270
TOTAL LOAD FOR YEAR (TONS) 1569043

TABLE 18.5 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	8260	11	245	6430	10	174	4530	4	49
2	8050	10	217	6740	10	182	4430	5	60
3	7760	9	189	6550	8	141	4400	6	71
4	7520	17	345	6360	7	120	4430	6	72
5	7320	5	99	6180	6	100	4430	4	48
6	7200	3	58	6140	6	99	4180	3	34
7	7120	4	77	6030	6	98	3600	4	39
8	6970	5	94	5780	6	94	3600	3	29
9	6810	5	92	5600	6	91	3800	16	164
10	6620	4	71	5500	7	104	4120	25	278
11	6550	7	124	5460	6	88	4370	25	295
12	6620	8	143	5570	8	120	4620	34	424
13	6890	11	205	5850	7	111	4430	36	431
14	7080	7	134	5920	6	96	4050	35	383
15	6930	6	112	5670	6	92	4490	18	218
16	6740	5	91	5430	5	73	4180	12	135
17	6510	5	88	5260	6	85	4080	11	121
18	6320	5	85	5020	7	95	4120	10	111
19	6180	4	67	4790	7	91	4080	7	77
20	6100	4	66	4820	9	117	4000	5	54
21	6070	7	115	4950	8	107	3000	7	57
22	6000	8	130	5160	8	111	2600	6	42
23	5890	7	111	5460	8	118	2700	4	29
24	5780	8	125	5500	7	104	2900	3	23
25	5710	8	123	5290	8	114	2700	4	29
26	5850	7	111	5090	9	124	2600	12	84
27	6280	7	119	4820	4	52	2500	13	88
28	6400	7	121	4720	4	51	1900	12	62
29	6400	7	121	4550	4	50	1800	6	29
30	6400	9	156	4660	4	50	1900	12	62
31	6510	10	176	--	--	--	2000	12	65
TOTAL	206840	--	4010	165380	--	3052	110540	--	3663

TABLE 18.6 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	2100	--	--	2600			2600	--	--
2	2200	--	--	2700	--	--	2600	--	--
3	2300	--	--	2800	--	--	2700	--	--
4	2400	--	--	2900	--	--	2700	--	--
5	2500	--	--	3000	--	--	2800	--	--
6	2600	--	--	2900	--	--	2900	--	--
7	2900	--	--	2800	--	--	2800	--	--
8	3500	--	--	2700	--	--	2800	--	--
9	4200	--	--	2700	--	--	2700	--	--
10	4300	--	--	2600	--	--	2700	--	--
11	4200	--	--	2600	--	--	2700	--	--
12	4000	--	--	2600	--	--	2800	--	--
13	3800	--	--	2700	--	--	2800	--	--
14	3600	--	--	2700	--	--	2800	--	--
15	3600	--	--	2700	--	--	2900	--	--
16	3600	--	--	2800	--	--	3000	--	--
17	3700	--	--	2900	--	--	3300	18	160
18	3700	--	--	3000	--	--	3700	37	370
19	3600	--	--	2900	--	--	3900	53	568
20	3500	--	--	2800	--	--	4010	60	690
21	3500	--	--	2700	--	--	3780	42	429
22	3400	--	--	2700	--	--	3700	25	250
23	3300	--	--	2600	--	--	3700	20	200
24	3200	--	--	2500	--	--	3630	19	186
25	2900	--	--	2400	--	--	3530	19	181
26	2600	--	--	2400	--	--	3480	23	214
27	2800	--	--	2500	--	--	3530	24	229
28	3000	--	--	2500	--	--	3800	36	389
29	2700	--	--	--	--	--	4190	40	453
30	2400	--	--	--	--	--	4400	33	392
31	2500	--	--	--	--	--	4820	57	742
TOTAL	98600	--	3190	75700	--	2460	101740	--	6871

TABLE 18.7 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)[1]
1	5340	62	894	22100	64	3820	45100	229	27900
2	5830	54	850	20900	58	3270	42400	161	18400
3	6110	53	874	19900	52	2790	45000	228	27700
4	6280	56	950	19300	38	1980	52700	479	68200
5	6350	53	909	18900	39	1990	61100	767	127000
6	6910	72	1340	19200	44	2280	65800	802	142000
7	8320	125	2810	21200	54	3090	69000	851	159000
8	9480	157	4020	24300	80	5250	66500	660	119000
9	9970	133	3560	27200	148	10900	58000	258	40400
10	10500	115	3380	31800	224	19200	50900	276	37900
11	12000	123	3990	38700	263	27500	49900	264	35600
12	12600	105	3570	46100	288	35800	48800	148	19500
13	13300	112	4020	52200	530	74700	47000	178	22600
14	14000	100	3780	55800	597	89900	42800	161	18600
15	13800	107	3990	57700	639	99500	36800	177	17600
16	13400	80	2890	54000	549	80000	33400	161	14500
17	13900	77	2890	46100	352	43800	31800	140	12000
18	15800	100	4270	41100	232	25700	31900	121	10400
19	18200	180	8850	38500	205	21300	33000	170	15100
20	18000	142	6900	37000	206	20600	36200	78	7620
21	16100	77	3350	35900	166	16100	42400	252	28800
22	14700	53	2100	35000	142	13400	48300	198	25800
23	16000	70	3020	36800	148	14700	47100	322	40900
24	24400	362	23000	41700	240	27000	44400	377	45200
25	31700	596	51000	48200	414	53900	43000	168	19500
26	29900	320	25800	56700	395	60500	47300	186	23800
27	25700	236	16400	62000	570	95400	48400	218	28500
28	22500	107	6500	59200	648	104000	50400	198	26900
29	22000	72	4280	50000	364	49100	50000	181	24400
30	22600	76	4640	45700	213	26300	48800	159	20900
31	--	--	--	48400	319	41700	--	--	--
TOTAL	446040	--	204827	1211600	--	1075470	1418200	--	1225720

TABLE 18.8 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)[1]
1	45400	227	27800	12900	12	418	6700	5	90
2	42600	128	14700	12300	11	365	6560	7	124
3	40000	103	11100	11900	13	418	6320	7	119
4	39600	85	9090	11700	13	411	6180	5	83
5	39200	73	7730	11200	13	393	6180	7	117
6	37600	76	7720	11000	17	505	6180	6	100
7	35700	81	7810	10800	22	642	6140	7	116
8	33500	61	5520	10500	16	454	5930	4	64
9	31500	50	4250	10100	13	355	5790	6	94
10	30000	46	3730	9840	11	292	5690	4	61
11	28900	48	3750	9640	13	338	5620	5	76
12	28400	44	3370	9480	13	333	5580	6	90
13	28000	39	2950	9360	12	303	5650	6	92
14	25900	40	2800	9200	21	522	5550	5	75
15	23300	43	2710	8920	14	337	5690	7	108
16	21700	51	2990	8640	11	257	6000	9	146
17	20300	51	2800	8480	12	275	5900	8	127
18	19100	39	2010	8560	10	231	5720	6	93
19	18300	30	1480	8400	8	181	5580	7	105
20	17700	35	1670	8080	9	196	5480	4	59
21	17300	27	1260	7880	12	255	5760	7	109
22	17200	16	743	7680	9	187	5860	10	158
23	17000	18	826	7400	6	120	6040	9	147
24	16300	18	792	7640	6	124	6210	17	285
25	15800	16	683	7440	7	141	6530	15	264
26	15500	21	879	7440	15	301	6740	14	255
27	16000	17	734	7640	6	124	6630	13	233
28	15400	17	707	7520	6	122	6530	12	212
29	14300	16	618	7300	6	118	6280	13	220
30	13800	13	484	7120	6	115	6210	13	218
31	13400	11	398	6950	5	94	--	--	--
TOTAL	778700	--	134104	283010	--	8927	181230	--	4040

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 5077580
TOTAL LOAD FOR YEAR (TONS) 3678024

TABLE 18.9 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	6740	13	237	4400	5	59	3100	4	33
2	7900	17	358	4340	7	82	3000	3	24
3	8080	13	284	4280	7	81	2900	2	16
4	7680	13	270	4340	8	94	2900	4	31
5	7230	9	176	4280	10	116	2900	3	23
6	6700	7	127	4610	22	274	3080	3	25
7	6490	5	88	4880	9	119	3250	2	18
8	6280	5	85	4540	7	93	3330	2	18
9	6190	5	83	4790	7	91	3530	3	29
10	6140	4	66	4670	6	76	3400	12	110
11	6140	4	66	4580	5	62	3200	11	95
12	6000	3	49	4490	12	145	3150	6	51
13	5790	3	47	4460	4	48	3180	7	60
14	5620	2	30	4340	4	47	3280	9	80
15	5550	1	15	4280	4	46	3380	10	91
16	5410	2	29	4220	5	57	3480	4	38
17	5270	2	28	4280	7	81	3480	3	28
18	5150	3	42	4280	9	104	3380	2	18
19	5030	3	41	4130	5	56	3250	2	18
20	4970	4	54	4040	4	44	3230	2	17
21	4940	5	67	4100	4	44	3150	2	17
22	4850	4	52	4100	6	66	3200	3	26
23	4790	4	52	4010	5	54	3330	4	36
24	4790	4	52	3980	5	54	3280	6	53
25	4790	2	26	3550	6	64	3100	5	42
26	4700	2	25	3780	7	71	2900	4	31
27	4640	3	38	3650	5	49	2370	3	19
28	4640	4	50	3500	4	38	1800	2	9.7
29	4520	4	49	3300	3	27	1700	2	9.2
30	4490	4	48	3200	3	26	1600	3	13
31	4460	3	36	--	--	--	1600	4	17
TOTAL	175860	--	2670	126200	--	2268	92430	--	1095.9

TABLE 18.10 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	1600	4	17	2600	8	56	2500	2	14
2	1600	2	8.6	2700	3	22	2400	2	13
3	1500	2	8.1	2700	4	29	2400	2	13
4	1500	2	8.1	2700	3	22	2400	4	26
5	1300	3	11	2700	9	66	2400	5	32
6	1500	6	24	2700	5	36	2500	3	20
7	1600	8	35	2700	2	15	2600	5	35
8	1800	21	102	2700	3	22	2600	12	84
9	2000	11	59	2700	2	15	2700	13	95
10	2100	12	68	2700	2	15	2700	13	95
11	2200	8	48	2700	2	15	2660	12	86
12	2300	13	81	2700	3	22	2630	7	50
13	2400	9	58	2700	2	15	2580	8	56
14	2500	6	41	2700	2	15	2610	8	56
15	2600	8	56	2800	2	15	2680	7	51
16	2500	5	34	2900	2	16	2730	9	66
17	2400	4	26	3000	2	16	2850	6	46
18	2300	4	25	3100	2	17	2900	5	39
19	2300	3	19	3100	2	17	2800	5	38
20	2400	3	19	3000	3	24	2750	7	52
21	2500	4	27	2900	3	23	2730	5	37
22	2600	4	28	2900	3	23	2750	7	52
23	2700	4	29	2800	5	38	2800	11	83
24	2800	7	53	2700	6	44	2880	11	86
25	2900	6	47	2600	5	35	2930	10	79
26	3000	4	32	2600	3	21	2930	9	71
27	3000	4	32	2500	5	34	2900	10	78
28	2900	3	23	2500	3	20	2880	11	86
29	2800	3	23	--	--	--	2900	10	78
30	2700	3	22	--	--	--	2880	7	54
31	2600	4	28	--	--	--	2880	9	70
TOTAL	70900	--	1091.5	77100	--	708	83050	--	1741

TABLE 18.11 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCEN-TRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)[1]	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCEN-TRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)[1]	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCEN-TRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)[1]
1	2880	4	31	3500	23	217	24400	162	10700
2	2850	4	31	3650	26	256	25600	162	11200
3	2880	6	47	4160	26	292	31300	179	15100
4	2880	11	86	5650	26	397	40700	182	20000
5	2880	11	86	7640	42	866	47300	213	27200
6	3080	11	91	10800	116	3380	50300	197	26800
7	3580	11	106	14600	124	4890	50100	196	26500
8	3980	9	97	17000	102	4680	48100	144	18700
9	3860	8	83	17100	80	3690	45000	107	13000
10	3750	6	61	16800	61	2770	42500	111	12700
11	3890	6	63	15900	51	2190	38400	99	10300
12	4010	7	76	14800	39	1560	32200	46	4000
13	3920	6	64	13400	39	1410	27300	43	3170
14	3750	5	51	12100	44	1440	25500	46	3170
15	3550	5	48	11200	142	4290	26200	52	3680
16	3450	5	47	11500	162	5030	29100	137	10800
17	3330	5	45	15100	174	7090	33300	154	13800
18	3230	6	52	23500	158	10000	36400	151	14800
19	3230	6	52	26600	95	6820	35200	129	12300
20	3350	6	54	26000	84	5900	33600	36	3270
21	3500	8	76	25900	94	6570	32000	30	2590
22	3600	10	97	26500	121	8660	30300	34	2780
23	3680	10	99	28300	118	9020	29600	31	2480
24	3750	12	122	30200	120	9780	28000	37	2800
25	3860	7	73	31400	117	9920	25500	36	2480
26	3890	6	63	33600	112	10200	24000	50	3240
27	3750	5	51	40500	104	11400	22400	47	2840
28	3630	7	69	41800	89	10000	21800	21	1240
29	3550	7	67	35200	53	5040	22300	20	1200
30	3500	8	76	29800	48	3860	21600	21	1220
31	--	--	--	26400	66	4700	--	--	--
TOTAL	105040	--	2064	620600	--	156318	980000	--	284060

TABLE 18.12 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCEN-TRATION (MG/L)	JULY SEDIMENT DISCHARGE (TONS/DAY)[1]	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCEN-TRATION (MG/L)	AUGUST SEDIMENT DISCHARGE (TONS/DAY)[1]	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCEN-TRATION (MG/L)	SEPTEMBER SEDIMENT DISCHARGE (TONS/DAY)[1]
1	21400	19	1100	9600	20	518	5340	7	101
2	20800	9	505	9300	13	326	5220	10	141
3	19600	9	476	9000	8	194	5190	8	112
4	18500	9	450	8650	10	234	5470	7	103
5	18000	9	437	8460	12	274	5600	6	91
6	18100	10	489	8280	11	246	5530	6	90
7	18000	5	243	8160	8	176	5370	6	87
8	17000	6	275	8090	10	218	5250	6	85
9	16000	9	389	8020	7	152	5370	5	72
10	15500	5	209	7870	7	149	5440	3	44
11	15000	12	486	7540	7	143	5280	4	57
12	14400	17	661	7120	8	154	5120	4	55
13	13800	6	224	6910	14	261	4970	4	54
14	13100	9	318	6770	16	292	4910	10	133
15	12400	8	268	6700	20	362	4780	7	90
16	11600	13	407	6560	11	195	4660	14	[illegible]
17	11300	13	397	6250	11	186	4540	30	368
18	11200	8	242	6120	10	165	4450	6	72
19	11200	6	181	6060	8	131	4480	5	60
20	10800	6	175	5920	7	112	5090	6	82
21	10500	7	198	5730	5	77	6060	6	98
22	10000	7	189	5600	4	60	6020	7	114
23	9800	13	344	5530	10	149	5890	7	111
24	9600	15	389	5500	9	134	5960	4	64
25	9400	19	482	5500	7	104	5890	6	95
26	9200	22	546	5500	7	104	5660	3	46
27	9300	16	402	5440	9	132	5370	14	203
28	9500	6	154	5370	7	101	5190	13	182
29	9700	10	262	5340	7	101	5090	10	137
30	9800	13	344	5310	8	115	5060	9	123
31	9800	13	344	5440	17	250	--	--	--
TOTAL	414300	--	11586	211640	--	5815	158250	--	3246

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 3116170
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 472663.7

TABLE 10.13 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCEN-TRATION (MG/L)	OCTOBER SEDIMENT DISCHARGE (TONS/DAY)[1]	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCEN-TRATION (MG/L)	NOVEMBER SEDIMENT DISCHARGE (TONS/DAY)[1]	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCEN-TRATION (MG/L)	DECEMBER SEDIMENT DISCHARGE (TONS/DAY)[1]
1	5060	8	109	3730	4	40	2900	17	133
2	5030	5	68	3760	2	20	3000	22	178
3	5000	8	108	3760	2	20	3100	28	234
4	4940	5	67	3730	3	30	3000	17	138
5	4910	5	66	3640	2	20	2900	22	172
6	4880	5	66	3700	2	20	2800	20	151
7	4970	5	67	3700	3	30	3400	18	165
8	5190	6	84	3730	3	30	3900	30	316
9	5120	6	83	3810	4	41	4000	10	108
10	5030	4	54	3870	4	42	3700	4	40
11	4940	4	53	3870	4	42	3500	9	85
12	4810	5	65	3840	3	31	3300	4	36
13	4720	11	140	3780	4	41	3100	4	33
14	4660	11	138	3730	8	81	3000	6	49
15	4570	10	123	3670	3	30	3100	6	50
16	4450	11	132	3640	4	39	3200	10	86
17	4450	7	84	3640	5	49	3300	10	89
18	4450	7	84	3670	4	40	3400	13	119
19	4190	7	79	3640	4	39	3300	5	45
20	4190	6	68	3620	5	49	3000	12	97
21	4220	6	68	3620	3	29	2800	17	129
22	4220	6	68	3100	2	17	2400	17	110
23	4250	4	46	2300	3	19	1900	21	108
24	4250	5	57	1900	3	15	1600	6	26
25	4300	4	46	2300	5	31	1300	4	14
26	4250	5	57	3000	11	89	1600	8	35
27	4190	4	45	2900	8	63	1900	5	26
28	4070	4	44	2700	6	44	2200	11	65
29	3960	4	43	2500	2	14	2500	10	68
30	3840	3	31	2700	4	29	2800	8	60
31	3780	3	31	--	--	--	3000	30	243
TOTAL	140890	--	2274	101550	--	1084	88900	--	3208

TABLE 10.14 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCEN-TRATION (MG/L)	JANUARY SEDIMENT DISCHARGE (TONS/DAY)[1]	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCEN-TRATION (MG/L)	FEBRUARY SEDIMENT DISCHARGE (TONS/DAY)[1]	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCEN-TRATION (MG/L)	MARCH SEDIMENT DISCHARGE (TONS/DAY)[1]
1	2900	10	78	7000	32	605	3260	6	53
2	2600	5	35	6600	17	303	3130	8	68
3	2200	7	42	6200	16	268	3180	8	69
4	1900	7	36	5600	21	318	3160	6	51
5	1600	11	48	5000	32	432	3050	4	33
6	1400	8	30	4000	14	151	2920	5	39
7	1600	3	13	3000	7	57	2920	15	118
8	1700	4	18	2700	6	44	2970	8	64
9	1800	6	29	2500	8	54	2970	4	32
10	1900	12	62	3000	6	49	2970	6	48
11	1800	10	49	3500	10	95	2990	8	65
12	1700	6	28	4000	16	173	3070	7	58
13	1600	7	30	4500	17	207	3070	7	58
14	1700	12	55	5000	22	297	3020	4	33
15	1900	14	72	5500	37	549	2990	5	40
16	2100	11	62	6000	33	535	2940	5	40
17	2300	13	81	5600	29	438	2890	4	31
18	2600	20	140	5300	34	487	2840	3	23
19	2900	15	117	5000	28	378	2760	2	15
20	3400	8	73	4570	26	321	2710	4	29
21	3900	7	74	4190	21	238	2760	2	15
22	4100	7	77	3960	17	182	2740	2	15
23	4000	7	76	3780	14	143	2710	3	22
24	3900	9	95	3780	13	133	2690	4	29
25	3900	4	42	3810	10	103	2810	7	53
26	3800	6	62	3760	11	112	2890	7	55
27	3800	7	72	3590	10	97	2990	6	48
28	3700	14	140	3400	7	64	2940	5	40
29	3700	13	130	--	--	--	2890	7	55
30	4500	16	194	--	--	--	2970	5	40
31	6000	12	194	--	--	--	3210	10	87
TOTAL	86900	--	2254	124840	--	6833	91410	--	1426

TABLE 18.15 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	3320	9	81	14700	37	1470	57000	193	29700
2	3260	11	97	16200	75	3280	53000	165	23600
3	3240	15	131	19600	136	7200	53000	146	20900
4	3240	8	70	25200	241	16400	55000	137	20300
5	3290	15	133	32100	329	28500	58000	169	26500
6	3430	23	213	37200	382	38400	61000	294	48400
7	3810	26	267	37600	260	26400	62000	257	43000
8	4480	27	327	36800	190	18900	63000	247	42000
9	4910	29	384	38000	171	17500	64000	241	41600
10	5560	46	691	40600	202	22100	58000	219	34300
11	6120	57	942	41800	211	23800	52000	165	23200
12	5920	20	320	44900	235	28500	44800	111	13400
13	5500	20	297	52000	390	54800	43400	95	11100
14	5340	21	303	58000	653	102000	46400	104	13000
15	5600	28	423	53000	444	63500	47800	118	15200
16	6350	30	514	45000	232	28200	42400	96	11000
17	6590	28	498	37200	128	12900	36800	88	8740
18	6490	30	526	31600	108	9210	33600	71	6440
19	6250	19	321	27900	73	5500	32300	57	4970
20	6390	34	587	25800	61	4250	32400	51	4460
21	7500	47	952	25200	54	3670	34600	60	5610
22	9030	77	1880	24500	53	3510	38800	83	8700
23	10500	113	3200	25100	64	4340	44600	116	14000
24	12600	142	4830	28200	88	6700	50000	152	20500
25	15500	196	8200	34800	165	15500	53000	197	28200
26	17900	264	12800	45000	307	37300	52000	243	34100
27	17200	101	4690	54000	326	47500	47100	168	21400
28	16300	53	2330	64000	373	64500	39200	103	10900
29	15200	52	2130	67000	692	125000	33500	72	6510
30	14600	32	1260	63000	446	75900	30300	60	4910
31	--	--	--	60000	290	47000	--	--	--
TOTAL	235420	--	49397	1206000	--	943730	1419000	--	596640

TABLE 18.16 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	29900	55	4440	17300	48	2240	8100	17	372
2	30000	59	4780	17400	35	1640	8500	12	275
3	29800	51	4100	18000	15	729	8570	12	278
4	28900	48	3750	17500	11	520	8350	16	361
5	27000	60	4370	17000	14	643	7940	14	300
6	25300	54	3690	16500	12	535	7610	23	473
7	24400	52	3430	16000	12	518	7400	7	140
8	22700	43	2640	15500	8	335	7500	10	203
9	21000	81	4590	15000	12	486	7830	15	317
10	20800	43	2410	14500	8	313	7500	17	344
11	24900	36	2420	14000	11	416	7120	18	346
12	28500	61	4690	12900	8	279	7080	10	191
13	27700	43	3220	12100	5	163	6910	10	187
14	25300	38	2600	11600	7	219	6940	11	206
15	24300	40	2620	11100	8	240	6630	9	161
16	24600	41	2720	10600	8	229	6350	7	120
17	25800	55	3830	10100	6	164	6090	5	82
18	27200	67	4920	9610	7	182	5960	10	161
19	26800	48	3470	9220	7	174	5830	10	157
20	26800	48	3470	9200	8	199	5730	8	124
21	27700	44	3290	8800	14	333	5660	7	107
22	27800	40	3000	8600	13	302	5530	10	149
23	27300	40	2950	8600	9	209	5440	12	176
24	26500	36	2580	8800	10	238	5280	15	214
25	25800	32	2230	8700	8	188	5120	11	152
26	23700	25	1600	8300	10	224	5060	10	137
27	20900	26	1470	8000	12	259	5000	9	122
28	19500	29	1530	7600	9	185	4970	8	107
29	19000	33	1690	7400	13	260	5060	13	178
30	18600	28	1410	7500	22	446	5060	10	137
31	17700	26	1240	7700	20	416	--	--	--
TOTAL	776200	--	95150	365130	--	13284	196120	--	6277

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 4832360
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 1721557

TABLE 18.17 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	4900	12	159	3900	5	53	3400	10	92
2	4900	9	119	4000	3	32	3300	8	71
3	4800	11	143	4000	7	76	3200	7	60
4	4700	8	102	4100	11	122	3000	9	73
5	4600	8	99	4400	7	83	2900	4	31
6	4700	8	102	4300	6	70	2800	7	53
7	4900	8	106	4000	4	43	2800	11	83
8	5100	8	110	3800	7	72	2700	15	109
9	5200	10	140	3700	5	50	2300	26	161
10	5200	9	126	3900	5	53	2400	11	71
11	5100	7	96	4100	11	122	2500	8	54
12	5000	9	122	4400	5	59	2300	7	43
13	4900	6	79	4400	7	83	2200	12	71
14	4900	4	53	4400	6	71	2200	10	59
15	5100	7	96	4400	6	71	2800	7	53
16	5200	6	84	4300	6	70	2700	7	51
17	5100	5	69	4200	4	45	2600	13	91
18	4900	3	40	4100	5	55	3000	6	49
19	4700	4	51	4000	6	65	2800	4	30
20	4600	3	37	3900	10	105	3000	8	65
21	4700	4	51	3900	7	74	3000	7	57
22	4700	7	89	3900	5	53	3000	7	57
23	4600	6	75	3900	5	53	3200	7	60
24	4500	5	61	3800	14	144	3200	4	35
25	4500	3	36	3800	17	174	3000	4	32
26	4500	5	61	3700	7	70	3000	5	41
27	4500	5	61	3600	7	68	2700	4	29
28	4600	4	50	3600	5	49	2600	5	35
29	4400	7	83	3500	5	47	2500	8	54
30	4100	5	55	3500	6	57	2400	7	45
31	4000	6	65	--	--	--	2500	5	34
TOTAL	147600	--	2620	119500	--	2189	86000	--	1849

TABLE 18.18 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	2500	2	14	2400	3	19	4400	16	190
2	2600	2	14	2600	2	14	4500	12	146
3	2800	3	23	2800	3	23	4400	8	95
4	3000	5	41	3000	2	16	4200	6	68
5	2900	7	55	3100	3	25	4000	8	86
6	2700	5	36	3000	2	16	4200	8	91
7	2600	3	21	2900	4	31	4200	7	79
8	2600	1	7.0	2800	4	30	4200	11	125
9	2600	5	35	2700	3	22	4200	8	91
10	2600	5	35	2600	4	28	4100	10	111
11	2500	4	27	2500	4	27	4200	18	204
12	2300	3	19	2500	4	27	4400	21	249
13	2200	3	18	2700	4	29	4600	15	186
14	2100	2	11	2900	5	39	4700	19	241
15	2100	2	11	3000	4	32	5200	21	295
16	2100	3	17	3200	5	43	5300	27	386
17	2200	4	24	3500	6	57	5800	26	407
18	2300	2	12	3500	4	38	6000	33	535
19	2300	5	31	3300	6	53	6300	31	527
20	2400	2	13	3000	5	41	6600	29	517
21	2900	4	31	3400	5	46	4700	32	406
22	3500	5	47	3500	5	47	2000	33	178
23	3400	3	28	3500	4	38	2100	30	170
24	3100	3	25	3300	3	27	2100	25	142
25	2600	2	14	3100	4	33	2200	24	143
26	2500	4	27	3100	3	25	2200	19	113
27	2300	2	12	3100	4	33	2200	17	101
28	2000	1	5.4	3700	8	80	2200	19	113
29	1900	5	26	3900	18	190	2200	20	119
30	2000	2	11	--	--	--	2600	30	211
31	2200	3	18	--	--	--	2600	33	232
TOTAL	77800	--	708.4	88600	--	1129	122600	--	6557

KOOTENAI RIVER AT COPELAND, IDAHO

TABLE 19.1

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	5300	12	172	6550	2	36	4480	4	48
2	5280	--	100	6670	1	18	4610	4	50
3	5350	--	87	6650	1	18	4660	4	50
4	5510	--	74	6810	1	18	4740	6	77
5	5560	--	75	6620	1	18	5260	4	57
6	5740	--	93	6240	1	17	5060	6	82
7	5410	4	58	5850	1	16	5070	5	68
8	5350	4	58	5550	1	15	5040	5	68
9	5350	5	72	5360	1	14	4640	4	50
10	5150	4	56	5300	1	14	4640	3	38
11	5230	4	56	6180	1	17	4690	12	150
12	5510	8	119	6260	2	34	4940	8	107
13	5870	7	111	6220	2	34	4590	18	223
14	6110	8	132	6050	3	49	3870	6	63
15	6490	6	105	5860	3	47	3550	4	38
16	6260	8	135	6010	2	32	3050	4	33
17	5890	8	127	6300	2	34	3000	2	16
18	5540	6	90	6280	4	68	3050	4	33
19	5450	7	104	6280	5	85	3120	5	42
20	5490	4	59	5900	3	48	3250	6	53
21	5250	6	85	5820	8	126	3450	6	56
22	5580	7	105	5740	6	93	3700	4	40
23	5580	5	75	5520	4	60	4500	4	49
24	5970	1	16	5150	4	56	4680	4	51
25	5770	1	16	5120	5	69	5580	2	30
26	5840	1	16	5040	4	54	6360	4	69
27	5560	1	15	4820	2	26	6320	2	34
28	6410	1	17	4670	4	50	6000	4	65
29	7300	1	20	4590	4	50	5730	9	139
30	6530	4	71	4570	6	74	5460	4	59
31	6150	2	33	--	--	--	5500	4	59
TOTAL	177820	--	2352	174100	--	1290	142590	--	1997

TABLE 19.2

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	5420	4	59	4850	2	26	7400	10	200
2	4540	6	74	5200	5	70	7400	8	160
3	4150	2	23	5600	6	91	7500	8	162
4	3700	2	20	6200	4	67	7900	6	128
5	3700	3	30	7300	5	99	8600	15	348
6	3800	2	21	7060	8	152	9400	10	254
7	3940	2	21	6500	8	140	10200	10	275
8	4010	1	11	6200	7	117	10100	16	436
9	4050	1	11	6000	3	49	9600	9	233
10	4080	2	22	5800	2	31	9130	10	247
11	4040	2	22	5600	4	60	8470	8	183
12	3580	2	21	5500	3	45	7920	12	257
13	3880	1	10	5300	4	57	7570	10	204
14	4000	1	11	5200	2	28	7330	7	139
15	4300	1	12	5080	2	27	7270	8	157
16	4500	1	12	5060	1	14	7120	8	154
17	4700	2	25	5060	4	55	7430	12	241
18	4650	2	25	5100	3	41	7720	--	250
19	4600	3	37	5200	10	140	7710	--	210
20	4600	3	37	5400	4	58	7500	--	160
21	4800	2	26	5600	10	151	7310	--	140
22	5170	2	28	6100	4	66	7100	--	120
23	5500	4	59	6600	12	214	6970	--	94
24	5600	6	91	7200	11	214	7060	--	110
25	5600	6	91	8200	14	310	7220	--	140
26	5500	5	74	8000	20	432	7500	9	182
27	4630	5	63	7600	19	390	7750	12	251
28	4200	6	68	7600	22	451	7920	14	299
29	4140	12	134	7500	12	243	9170	15	371
30	4300	1	12	--	--	--	10600	23	660
31	4600	1	12	--	--	--	11400	13	400
TOTAL	138720	--	1162	177610	--	3838	253270	--	7165

TABLE 19.3 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	11000	13	386	15900	41	1760	50300	85	11500
2	10400	15	421	19800	40	2140	48900	87	11500
3	9610	12	311	21200	50	2860	53400	140	20000
4	9090	12	295	21700	60	3520	65900	304	54100
5	8720	8	188	22400	44	2660	74200	583	117000
6	8560	10	231	22600	36	2070	72100	561	109000
7	8270	12	268	22100	29	1730	63400	270	46200
8	8010	5	195	21000	18	1020	58300	138	21700
9	7590	6	123	20600	12	667	55900	128	19300
10	7410	8	160	21000	13	737	55500	115	17200
11	7620	8	165	21900	24	1420	57100	132	20400
12	8360	10	226	23900	28	1810	59000	148	23600
13	8690	5	117	26800	41	2970	59900	177	28600
14	9760	7	166	31500	98	8330	59100	209	33400
15	8550	12	279	35500	100	9500	53300	126	18100
16	8820	12	286	36500	110	10800	46000	98	12200
17	8580	5	116	36000	126	12700	40900	85	9350
18	8440	6	137	36100	91	8870	38500	67	6560
19	8050	6	131	38400	102	10600	38800	78	8170
20	8030	4	87	41100	112	12400	41900	104	11800
21	8030	6	130	43500	258	30300	48200	115	15000
22	7920	5	107	47000	210	26600	51300	136	18800
23	7530	7	142	53500	109	15700	48100	119	15500
24	7480	6	121	55700	143	23100	44100	90	10700
25	7580	4	82	59600	125	20100	41200	70	7750
26	7650	7	145	55200	134	20000	39100	58	6120
27	7950	10	216	57300	147	20800	39500	62	6610
28	8240	14	311	51600	123	17100	44000	70	8320
29	8960	11	263	51400	93	12900	48300	120	16000
30	11400	34	1050	52400	113	16000	45100	101	12300
31	--	--	--	52400	107	15100	--	--	--
TOTAL	255320	--	6854	1114600	--	315844	1541300	--	717260

TABLE 19.4 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	39000	80	8400	15500	--	330	9180	7	174
2	33700	72	6550	14900	--	320	8670	7	164
3	30900	54	4450	13900	--	300	8500	5	115
4	29800	42	3380	13300	--	290	8510	4	92
5	31400	39	3310	13100	--	280	8370	4	90
6	33900	45	4120	12900	8	279	8050	5	109
7	35900	49	4750	13000	6	211	7720	6	125
8	37400	59	5960	13000	10	351	7470	6	121
9	38200	67	6910	12600	8	272	7590	4	82
10	36700	70	6940	12000	12	389	7720	4	83
11	34800	63	5920	11300	--	270	7970	4	86
12	33400	53	4780	11000	7	208	7740	4	84
13	31600	44	3750	10900	8	235	7620	7	144
14	30700	33	2740	10600	8	229	7670	11	228
15	29200	30	2370	10700	7	202	7570	4	82
16	25700	20	1390	11000	13	386	7820	6	127
17	23100	17	1060	11500	7	217	7750	4	84
18	21700	16	937	12100	4	131	8570	6	139
19	20500	16	886	11900	6	193	11300	5	153
20	19400	12	629	11200	6	181	11500	4	124
21	18800	11	558	10900	7	206	11400	6	185
22	19700	16	851	10700	--	170	11100	6	180
23	20400	10	551	10800	--	170	11000	4	119
24	19600	8	423	10900	--	140	10500	6	170
25	18800	--	410	10000	--	110	10200	6	165
26	18300	--	400	9490	--	77	10100	4	109
27	17400	--	380	9050	--	49	9740	4	105
28	16500	--	360	9480	2	51	9740	4	105
29	16000	--	350	9700	1	76	9880	2	53
30	15900	--	340	10000	1	27	9990	3	81
31	15900	--	340	10000	2	54	--	--	--
TOTAL	813800	--	84195	357020	--	6354	270940	--	3678

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 5417090
TOTAL LOAD FOR YEAR (TONS) 1151589

TABLE 19.5 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCENTRATION (MG/L)	OCTOBER LOAD (TONS)[1]	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCENTRATION (MG/L)	NOVEMBER LOAD (TONS)[1]	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCENTRATION (MG/L)	DECEMBER LOAD (TONS)[1]
1	9950	2	54	9350	4	100	7520	2	41
2	9850	1	27	9550	4	100	7300	2	39
3	9530	2	51	9450	3	77	6880	2	37
4	9030	4	98	9350	3	76	7800	6	130
5	8870	2	48	9150	3	74	8130	9	198
6	8680	2	47	8860	3	72	7820	2	42
7	8580	2	46	8530	3	69	7030	5	95
8	8580	4	93	8240	3	67	6590	2	36
9	8460	4	91	7940	3	64	6700	8	145
10	8170	5	110	7950	3	64	7000	4	76
11	7890	2	43	7620	3	62	7970	2	43
12	8270	6	134	8450	5	110	8650	6	140
13	8590	3	73	9550	9	230	8560	12	280
14	9320	4	100	9660	6	160	8040	14	300
15	9420	4	100	9060	4	98	7180	12	230
16	9280	3	75	8690	3	70	7260	2	39
17	9230	3	75	8400	3	69	7380	3	60
18	8760	3	71	8080	2	44	8080	2	44
19	8600	3	70	7730	2	42	7000	2	36
20	8270	3	67	7600	2	41	7030	2	38
21	8440	4	91	7160	2	39	6490	2	35
22	8240	3	67	7560	3	61	6310	2	34
23	8110	2	44	8970	10	240	6250	2	34
24	7940	2	43	9640	9	230	5940	2	32
25	7840	2	42	9340	4	100	6120	4	66
26	8060	3	65	8750	3	71	6190	4	67
27	8650	5	120	8300	3	67	5850	3	47
28	8750	4	94	8040	3	65	5960	3	48
29	8920	4	96	7720	2	42	4880	3	40
30	8810	3	71	7450	2	40	4220	3	34
31	9250	5	120	--	--	--	3150	2	17
TOTAL	270920	--	2326	256220	--	2643	211280	--	2505

TABLE 19.6 DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCENTRATION (MG/L)	JANUARY LOAD (TONS)[1]	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCENTRATION (MG/L)	FEBRUARY LOAD (TONS)[1]	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCENTRATION (MG/L)	MARCH LOAD (TONS)[1]
1	2770	1	15	4100	2	22	4600	4	50
2	3200	5	43	4300	3	35	4700	4	51
3	3700	6	60	4500	3	36	4800	4	52
4	4100	5	55	4700	4	51	4900	4	53
5	4800	5	65	4800	4	52	5000	4	54
6	5400	5	73	4900	4	53	5000	4	54
7	6000	5	81	5000	4	54	5000	4	54
8	6300	5	85	5000	4	54	5000	4	54
9	6500	5	88	5000	4	54	5000	4	54
10	6700	5	90	5000	4	54	4900	4	53
11	6700	5	90	4900	4	53	4900	4	53
12	6700	4	72	4900	4	53	4900	4	53
13	6600	3	53	4800	4	52	4900	4	53
14	6600	3	53	4800	4	52	4900	4	53
15	6400	3	52	4800	4	52	4900	4	53
16	6300	3	51	4800	4	52	5000	5	68
17	6100	3	49	4900	4	53	5100	7	96
18	6000	3	49	4900	4	53	5180	8	110
19	5700	3	46	4900	4	53	6000	19	308
20	5300	3	43	4900	4	53	7000	20	378
21	4900	3	40	4800	4	52	7300	21	414
22	4600	2	25	4800	4	52	7300	18	355
23	4300	2	23	4700	4	51	7200	16	311
24	4190	2	23	4700	4	51	7200	13	253
25	4100	2	22	4700	4	51	7200	12	233
26	4000	2	22	4600	4	50	7270	10	196
27	4000	2	22	4600	4	50	7360	12	238
28	4000	2	22	4600	4	50	8360	6	135
29	4000	2	22	--	--	--	9690	4	105
30	4000	2	22	--	--	--	10800	6	175
31	4000	2	22	--	--	--	12400	14	465
TOTAL	157960	--	1478	133400	--	1398	193760	--	4638

TABLE 19.7

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	15800	30	1280	39600	60	6420	74100	130	26000
2	17400	28	1320	37400	44	4440	67500	150	27300
3	17900	22	1060	34900	46	4330	64600	138	24100
4	19200	14	688	33300	37	3330	68600	161	29800
5	18000	14	680	32300	35	3050	74800	173	34900
6	19400	24	1260	33200	29	2600	80400	250	54300
7	22100	34	2030	36800	40	3970	85500	345	75600
8	24300	84	5510	41600	52	5840	86500	364	85000
9	24300	82	5380	46300	70	8750	81000	360	78700
10	24700	66	4400	52800	78	11100	71900	221	42900
11	25700	74	5130	67100	170	29000	64700	204	35600
12	26600	84	6030	71500	250	48000	62800	156	26500
13	26500	82	5960	79700	350	75000	61400	176	29200
14	27500	91	6760	85400	400	92000	57200	136	21000
15	28100	75	5690	88300	530	130000	50100	140	18900
16	27900	52	3920	88000	530	130000	44400	93	11100
17	28200	30	2280	80800	530	120000	41000	85	9410
18	29600	78	6230	71100	295	56600	39500	76	8110
19	32300	90	7850	64800	150	26200	39400	75	7980
20	32800	88	7790	61300	162	26800	40800	82	9030
21	31900	90	7750	58100	174	27300	44500	75	9010
22	32000	85	7340	56000	130	19700	51100	120	17000
23	32300	110	9600	56400	88	13400	54600	140	21000
24	39800	300	32000	60900	130	21400	52600	180	25600
25	52800	580	83000	66900	161	29100	52100	122	17200
26	52300	340	48000	74500	268	53900	54000	125	18200
27	46600	200	25200	81700	247	54500	60200	137	22300
28	41300	112	12500	83600	301	67900	63300	200	34000
29	40500	72	7870	78000	280	59000	63200	150	25600
30	41000	79	8750	77100	268	55800	62100	182	30500
31	--	--	--	79100	157	33500	--	--	--
TOTAL	898200	--	323258	1913500	--	1222930	1813900	--	675840

TABLE 19.8

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)[1]
1	58600	122	19300	16500	22	980	7950	8	172
2	53500	92	13300	15400	18	748	7620	6	123
3	51000	90	12400	14800	22	879	7140	8	154
4	49400	90	12000	14400	16	622	7070	10	151
5	49400	84	11200	13800	14	522	6920	8	149
6	48300	96	12500	13400	10	362	6990	6	113
7	45700	78	9620	13000	13	456	6990	7	132
8	43000	58	6730	12600	10	340	7010	8	151
9	40200	69	7490	12600	10	340	6620	14	250
10	37600	82	8320	11900	9	289	6540	21	371
11	35900	62	6010	11500	13	404	6200	22	368
12	35000	36	3400	10900	12	353	6200	18	301
13	34300	28	2590	10800	12	350	5920	12	192
14	33200	21	1880	10900	12	353	6140	10	166
15	30500	21	1730	10700	12	347	6330	8	137
16	28300	20	1500	10000	12	324	6390	7	121
17	26400	20	1400	10000	8	216	6770	7	128
18	24800	19	1300	9830	11	292	6790	2	37
19	23500	20	1300	9980	12	323	6720	2	36
20	22500	20	1200	9520	10	257	6650	1	18
21	21800	20	1200	9030	12	293	6830	3	55
22	21300	22	1270	9030	8	195	7220	5	97
23	21200	22	1260	8840	10	239	7310	5	99
24	20600	24	1330	8760	8	189	7830	6	130
25	19800	20	1070	8760	8	189	8040	6	130
26	19400	13	681	8550	7	162	7990	6	130
27	19600	17	900	8760	8	189	8250	8	180
28	19600	13	688	8760	10	237	8150	8	180
29	18500	14	699	8940	12	290	7900	8	171
30	17400	14	658	8520	6	138	7900	10	213
31	17000	22	1010	8340	6	135	--	--	--
TOTAL	987300	--	149936	338820	--	11013	212380	--	4659

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 7387540
TOTAL LOAD FOR YEAR (TONS) 2602660

TABLE 19.9 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	8250	10	223	5140	4	56	4170	3	34
2	9300	5	126	5020	2	27	4440	4	48
3	9850	8	213	5090	2	27	4560	4	49
4	9950	6	160	4840	6	78	4730	4	51
5	9260	10	250	5080	7	96	4780	4	52
6	8740	8	189	5390	3	44	4640	4	50
7	8400	4	91	5490	4	59	4680	4	51
8	7940	2	43	5740	4	62	4520	4	49
9	7790	3	63	5630	5	76	4420	4	48
10	7670	1	21	5530	5	75	4330	4	47
11	7720	1	21	5490	4	59	4250	4	46
12	7460	2	40	5400	4	58	4130	4	45
13	7200	1	19	5310	3	43	4320	4	47
14	6830	5	92	5350	4	58	4460	4	48
15	6720	3	54	5310	8	115	4330	4	47
16	6600	2	36	5200	7	98	4370	4	47
17	6330	1	17	5250	5	71	4510	4	49
18	6270	2	34	5250	4	57	4540	4	49
19	6230	3	50	5190	4	56	4350	4	47
20	6130	4	66	5150	3	42	4220	4	46
21	5870	1	16	5140	3	42	4160	4	45
22	5930	1	16	5380	4	58	3980	4	43
23	5790	1	16	5240	4	57	4000	3	32
24	5630	2	30	5070	4	55	4010	4	43
25	5650	1	15	5230	5	71	3970	4	43
26	5870	1	16	5270	2	28	3800	3	31
27	5710	1	15	4900	4	53	3670	6	59
28	5580	4	60	4800	4	52	3470	2	19
29	5410	2	29	4650	6	75	3430	4	37
30	5200	2	28	4320	5	58	3270	3	26
31	5080	2	27	--	--	--	3150	3	26
TOTAL	216160	--	2076	155840	--	1806	129660	--	1354

TABLE 19.10 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	3060	4	33	4100	4	44	3780	4	41
2	2990	2	16	4140	4	45	3700	4	40
3	2900	2	16	4200	4	45	3550	7	67
4	2970	4	31	4160	4	45	3620	6	59
5	2730	2	15	4180	4	45	3400	6	55
6	2630	3	21	4180	4	45	3650	4	39
7	2690	2	15	4280	4	46	3760	6	61
8	2630	2	14	4220	4	46	4040	7	76
9	2560	3	21	4240	4	46	3920	6	64
10	2580	2	14	4300	4	46	3810	6	62
11	2650	4	29	4260	4	46	3750	7	71
12	2760	4	30	4320	4	47	3850	10	104
13	2940	4	32	4320	4	47	3860	6	63
14	3320	2	18	4500	4	49	3920	6	64
15	3370	2	18	4490	4	48	4140	8	89
16	3600	4	39	4650	7	88	4330	10	117
17	3390	4	37	4710	6	76	4590	10	124
18	3490	4	38	4810	7	91	4560	8	98
19	3390	4	37	4730	7	89	4480	10	121
20	3510	4	38	4610	6	75	4370	8	94
21	3560	4	38	4540	9	110	4330	10	117
22	3680	4	40	4540	9	110	4430	12	144
23	3740	4	40	4440	10	120	4500	11	134
24	3880	2	21	4230	5	57	4670	19	240
25	4000	4	43	4170	6	68	5150	12	167
26	4040	4	44	3900	6	63	5080	14	192
27	4080	4	44	3920	6	64	5010	11	149
28	4260	4	46	3820	6	62	4970	14	188
29	4190	4	45	--	--	--	5170	14	195
30	4140	4	45	--	--	--	5230	12	169
31	4020	4	43	--	--	--	5140	10	139
TOTAL	103640	--	961	120560	--	1763	132760	--	3343

TABLE 19.11 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	4930	8	106	7070	6	115	38100	63	6480
2	4980	8	108	7290	6	118	37300	49	4930
3	5140	8	111	9020	6	146	40400	40	4360
4	4900	8	106	12400	8	268	48600	85	11200
5	5010	7	95	18200	26	1280	57400	173	26800
6	5170	9	126	26100	83	5850	62300	217	36500
7	6100	17	280	31900	140	12100	64000	288	49800
8	7240	12	235	34200	151	13900	62200	288	48400
9	7420	11	220	34600	139	13000	58900	202	32100
10	7650	12	248	34000	99	9090	55400	165	24700
11	8650	14	327	32600	69	6070	50700	142	19400
12	8500	10	229	30300	54	4420	44800	92	11100
13	8300	8	179	27300	39	2870	38200	83	8560
14	8070	6	131	24500	27	1790	33600	50	4540
15	7550	6	122	22600	24	1460	32200	50	4350
16	7040	3	57	22600	20	1220	35100	50	4740
17	6660	3	54	27900	35	2640	39400	43	4570
18	6360	4	65	38100	110	11300	42500	85	9750
19	6200	3	50	44100	140	16700	43300	92	10800
20	6470	5	87	45200	188	22900	41600	100	11200
21	6630	4	72	45200	135	16500	39600	96	10300
22	7060	7	133	45600	112	13800	37500	54	5470
23	7310	8	158	46500	112	14100	35600	36	3460
24	7330	7	139	48900	112	14800	34100	25	2300
25	7710	8	167	50100	143	19300	31800	15	1290
26	8000	8	173	53200	148	21300	29200	18	1420
27	7870	8	170	57000	150	23100	27300	16	1180
28	7670	8	166	60400	211	34400	25900	20	1400
29	7260	6	118	56200	189	28700	25500	18	1240
30	6990	6	113	47800	135	17400	25300	12	820
31	--	--	--	41700	87	9800	--	--	--
TOTAL	206170	--	4345	1082570	--	340437	1237800	--	263160

TABLE 19.12 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)[1]
1	24700	13	867	10500	8	235	5820	2	31
2	24200	12	784	10900	10	294	5710	2	31
3	23200	14	877	10700	7	202	5630	3	46
4	21900	10	591	10100	7	191	5810	1	16
5	20700	10	559	9730	6	158	6000	1	16
6	20200	10	545	9270	7	175	5830	2	31
7	20400	9	496	9000	7	170	6120	1	17
8	19800	9	428	8600	10	232	5980	1	16
9	18600	8	402	8720	9	212	5880	7	111
10	17600	6	285	8660	4	94	5960	11	177
11	17100	8	369	8520	7	161	6260	2	34
12	16600	12	538	8220	4	89	6030	4	65
13	16000	10	432	7490	5	101	5770	1	16
14	15300	6	248	7310	6	118	5410	1	15
15	14600	10	394	7260	5	98	5420	1	15
16	14000	14	529	7110	6	115	5240	2	28
17	13300	10	359	6830	4	74	5040	1	14
18	13000	10	351	6660	4	72	4890	1	13
19	12600	16	544	6610	2	36	4870	1	13
20	12400	8	268	6410	4	69	4880	1	13
21	12000	10	324	6380	2	34	5540	1	15
22	11700	16	505	6130	2	33	6290	1	17
23	11400	9	277	5980	4	65	6570	3	53
24	11200	7	212	5870	3	49	6490	2	35
25	11200	6	181	6040	4	65	6510	4	70
26	10800	6	175	5790	3	47	6310	3	51
27	10400	6	168	5900	2	32	6030	3	49
28	10300	6	167	5600	1	15	5780	2	31
29	10300	6	167	6210	11	184	5580	1	15
30	10600	6	172	5770	10	156	5520	1	15
31	11000	6	178	5670	4	61	--	--	--
TOTAL	477100	--	12392	234340	--	3636	173170	--	1069

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 4270170
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 726346

TABLE 19.13 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCENTRATION (MG/L)	OCTOBER SEDIMENT DISCHARGE (TONS/DAY)[1]	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCENTRATION (MG/L)	NOVEMBER SEDIMENT DISCHARGE (TONS/DAY)[1]	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCENTRATION (MG/L)	DECEMBER SEDIMENT DISCHARGE (TONS/DAY)[1]
1	5360	2	29	4890	2	26	3450	2	19
2	5420	2	29	4850	3	39	3540	2	19
3	5410	4	58	4820	6	78	3730	3	30
4	5370	5	72	4740	3	38	3670	4	40
5	5720	8	124	4750	3	38	3580	4	39
6	5590	7	106	4650	3	38	3700	4	40
7	5490	5	74	4610	3	37	4720	4	51
8	5620	4	61	4520	3	37	5690	5	77
9	5870	3	48	4930	3	40	5330	5	72
10	5770	4	62	5170	3	42	4970	5	67
11	5680	2	31	5040	3	41	4900	4	53
12	5760	3	47	4960	3	40	4500	4	49
13	5720	2	31	4880	3	40	3780	3	31
14	5640	2	30	4760	3	39	3780	3	31
15	5460	3	44	4750	3	38	4100	2	22
16	5300	3	43	4620	3	37	4330	2	23
17	5500	3	45	4740	3	38	4470	2	24
18	5220	4	56	4880	3	40	4430	2	24
19	5110	3	41	5010	3	41	4280	2	23
20	5050	8	109	5420	3	44	4220	2	23
21	4860	11	144	5400	3	44	3750	3	30
22	5110	4	55	5290	3	43	3430	2	19
23	5140	4	56	4020	3	33	3150	2	17
24	5250	3	43	3630	3	29	2820	1	7.6
25	5560	4	60	3800	3	31	2890	1	7.8
26	5410	4	58	3900	2	21	2980	2	16
27	5320	4	57	3850	2	21	3130	2	17
28	5140	6	83	3600	2	19	3510	1	9.5
29	5020	4	54	3420	2	18	3700	2	20
30	4970	5	67	3440	2	19	3940	3	32
31	4870	4	53	--	--	--	4240	3	34
TOTAL	166710	--	1870	137340	--	1089	122710	--	966.9

TABLE 19.14 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCENTRATION (MG/L)	JANUARY SEDIMENT DISCHARGE (TONS/DAY)[1]	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCENTRATION (MG/L)	FEBRUARY SEDIMENT DISCHARGE (TONS/DAY)[1]	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCENTRATION (MG/L)	MARCH SEDIMENT DISCHARGE (TONS/DAY)[1]
1	4050	3	33	18000	12	583	5760	6	93
2	3610	5	49	19300	52	2710	5460	4	59
3	3340	5	45	18200	70	3440	5280	3	43
4	3070	2	16	15100	57	2320	5480	3	44
5	2790	1	7.5	12500	37	1250	5280	2	29
6	2640	1	7.1	10100	16	436	5160	2	28
7	2750	1	7.4	8710	14	329	5020	1	14
8	2980	1	8.0	7900	14	299	4930	2	27
9	3240	1	8.7	7160	9	174	4900	4	53
10	3520	1	9.5	7490	10	202	4910	5	66
11	3610	1	9.7	7680	12	249	5100	8	110
12	3220	1	8.7	8030	12	260	5350	7	101
13	2900	1	7.8	8150	12	264	5630	6	91
14	3080	2	17	8330	11	247	5550	4	60
15	3280	6	53	8950	11	266	5330	4	58
16	3530	4	38	9950	11	296	5190	5	70
17	3910	4	42	10100	11	300	5200	3	42
18	4210	3	34	9570	11	284	4990	5	67
19	4910	3	40	8900	11	264	4890	6	79
20	6250	1	17	8220	10	222	4810	4	52
21	7290	2	39	7360	10	199	4870	5	66
22	7090	4	77	7180	10	194	4770	5	64
23	7100	3	58	6870	10	185	4710	3	38
24	6870	8	148	6540	10	177	4580	7	87
25	6950	7	129	6560	10	177	4710	7	89
26	6620	5	89	6460	6	105	5020	7	95
27	6380	5	86	6240	3	51	5420	9	132
28	6260	5	85	6040	3	49	5570	5	75
29	6310	3	51	--	--	--	5480	8	118
30	7070	2	38	--	--	--	5670	14	214
31	11400	4	123	--	--	--	6220	9	151
TOTAL	150080	--	1381.4	268590	--	15532	161240	--	2315

TABLE 19.15 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCEN-TRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)[1]	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCEN-TRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)[1]	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCEN-TRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)[1]
1	6460	8	140	30300	54	4420	81300	333	73100
2	6340	8	137	31700	52	4450	77600	272	57000
3	6290	8	136	36800	86	8540	73300	215	42600
4	6270	7	119	45400	153	18800	70400	196	37300
5	6370	8	138	55900	269	40600	70300	168	31900
6	6730	8	145	62400	368	62000	73100	207	40900
7	7440	8	161	64300	333	57800	75400	277	56400
8	9430	15	382	64600	239	41700	76200	347	71400
9	11100	39	1170	66300	265	47400	75900	278	57000
10	14500	46	1800	69600	298	56000	75400	236	48000
11	16500	29	1290	71500	315	60800	70300	208	39500
12	15600	25	1050	74100	320	64000	61500	167	27700
13	14100	18	685	80000	347	75000	57000	137	21100
14	13000	14	491	85300	350	80600	57400	131	20300
15	12700	15	514	68300	515	95000	58400	122	19200
16	13500	15	547	79100	409	87400	56900	135	20700
17	14300	16	618	66400	349	62600	51700	107	14900
18	14100	14	533	55200	252	37600	46800	105	13300
19	13400	13	470	47700	126	16200	43900	70	8300
20	13400	14	507	42900	89	10300	42800	41	4740
21	14900	14	563	40000	60	6480	43200	55	6420
22	19100	23	1190	38000	94	9640	47200	79	10100
23	23200	41	2570	38100	60	6170	51400	83	11500
24	28500	76	5850	41500	63	7060	56000	134	20300
25	31900	116	9990	49200	86	11400	60500	139	22700
26	35900	137	13300	58000	146	22900	61500	177	29400
27	36600	143	14100	68600	264	48900	51300	175	24200
28	34800	130	12200	77500	324	67800	51800	122	17100
29	32900	90	7990	84100	362	82200	45600	72	8880
30	31200	60	5050	87200	432	102000	40300	61	6640
31	--	--	--	85400	410	94500	--	--	--
TOTAL	510530	--	83836	1865400	--	1390260	1804400	--	862560

TABLE 19.16 SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCEN-TRATION (MG/L)	JULY SEDIMENT DISCHARGE (TONS/DAY)[1]	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCEN-TRATION (MG/L)	AUGUST SEDIMENT DISCHARGE (TONS/DAY)[1]	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCEN-TRATION (MG/L)	SEPTEMBER SEDIMENT DISCHARGE (TONS/DAY)[1]
1	37500	62	6280	15500	11	579	8350	6	135
2	36900	61	6080	19100	10	516	8730	5	118
3	36700	54	5350	14700	17	675	9100	5	123
4	35900	51	4940	17200	15	697	9300	5	126
5	34400	55	5110	17900	12	580	9090	6	147
6	32300	41	3580	18000	16	778	8720	7	165
7	30700	39	3230	17700	11	526	8120	6	132
8	29200	36	2840	17000	9	413	7830	5	106
9	26900	39	2830	16400	9	399	7760	3	63
10	28000	52	3930	15700	7	297	8260	4	89
11	27900	38	2860	15000	11	446	8100	5	109
12	32500	40	3510	14300	8	309	7710	7	146
13	34600	40	3740	13600	8	294	7560	6	122
14	32500	36	3160	12900	8	279	7380	6	120
15	29700	25	2000	12500	10	338	7410	2	40
16	29000	22	1720	12000	11	356	7210	1	19
17	29700	18	1440	11500	9	279	6780	3	55
18	31200	14	1180	10800	8	233	6510	4	70
19	32000	16	1380	11300	9	275	6290	6	102
20	31300	17	1440	9800	12	318	6370	5	86
21	31500	19	1620	9400	9	228	6090	4	66
22	32100	19	1650	9080	8	196	5950	3	48
23	31900	19	1640	8940	7	169	5880	2	32
24	31200	19	1600	8940	6	145	5750	4	62
25	29900	19	1530	9020	5	122	5620	7	106
26	28800	14	1090	8940	6	145	5470	4	59
27	25500	13	895	8520	9	207	5570	2	30
28	23000	12	745	8210	7	155	5580	2	30
29	21600	12	700	7980	5	108	5700	3	46
30	21300	12	690	7810	5	105	6020	4	65
31	20600	11	612	8000	6	130	--	--	--
TOTAL	936300	--	79372	391740	--	10297	214210	--	2617

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 6726290
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 2452056.3

TABLE 19.17

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	5990	10	162	4800	2	26	4490	3	36
2	5840	9	142	4610	2	25	4130	2	22
3	5830	7	110	4950	3	40	4230	2	23
4	5820	5	79	5620	3	46	3970	2	21
5	5670	4	61	5380	4	58	4100	2	22
6	5590	3	45	5440	2	29	3900	4	42
7	5670	3	46	4990	3	40	3700	3	30
8	5830	3	47	4700	3	38	3400	2	18
9	5960	3	48	4340	3	35	3350	2	18
10	6020	3	49	4670	3	38	3300	2	18
11	6140	3	50	5350	3	43	3400	2	18
12	5830	4	63	5610	5	76	3200	2	17
13	5820	4	63	5870	4	63	3100	2	17
14	6030	6	98	5730	2	31	3150	2	17
15	6220	8	134	5710	2	31	3200	2	17
16	6300	8	136	5560	3	45	3500	2	19
17	5980	7	113	5220	2	28	3700	1	10
18	5790	6	94	5050	1	14	3800	4	41
19	5560	5	75	4880	2	26	3850	3	31
20	5770	5	78	4920	4	53	3800	2	21
21	5760	5	78	4600	4	50	3850	2	21
22	5690	4	61	4850	2	26	3850	2	21
23	5620	4	61	4970	2	27	3900	1	11
24	5530	4	60	5070	3	41	4000	2	22
25	5220	4	56	4980	3	40	4000	2	22
26	5670	4	61	4830	2	26	3700	1	10
27	5860	4	63	4980	3	40	3000	2	16
28	5570	2	30	4870	2	26	2700	2	15
29	5300	2	29	4760	2	26	2600	3	21
30	5110	4	55	4460	2	25	2500	3	20
31	4740	3	38	--	--	--	2600	3	21
TOTAL	177730	--	2285	151970	--	1112	109970	--	688

TABLE 19.18

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	2800	1	7.6	3100	1	8.4	17300	60	2800
2	2900	4	31	3000	1	8.1	13500	31	1130
3	2950	2	16	2900	5	39	11000	33	980
4	3100	2	17	3200	8	69	9430	27	687
5	3200	2	17	3520	2	19	8610	29	674
6	3400	2	18	3670	2	20	9090	24	589
7	3500	2	19	3290	4	36	10200	22	606
8	3500	1	9.4	3230	7	61	9520	19	488
9	3450	2	19	3410	9	83	9060	20	489
10	3380	2	18	3480	6	56	8890	26	624
11	3300	2	18	3620	8	78	10300	22	612
12	3200	1	8.6	3730	6	60	12300	18	598
13	3050	2	16	3890	8	84	13500	22	802
14	2800	2	15	4000	7	76	16600	35	1570
15	2650	1	7.2	4050	5	55	17500	40	1890
16	2700	1	7.3	4450	7	84	17800	40	1920
17	2750	1	7.4	4970	5	67	22100	51	3040
18	2900	2	16	5400	2	29	26800	82	5930
19	3000	2	16	5410	7	102	27300	133	9800
20	3200	2	17	5270	8	114	25700	100	6940
21	3700	3	30	4930	5	67	23500	77	4890
22	4300	3	35	5330	5	72	18200	52	2560
23	4900	4	53	5300	7	100	16300	55	2420
24	4800	4	52	5220	6	85	16300	36	1580
25	4400	2	24	4980	8	108	15200	23	944
26	3800	2	21	4810	4	52	13700	21	777
27	3200	2	17	4990	3	40	12400	18	603
28	2800	3	23	7370	4	80	11300	21	641
29	2600	2	14	14500	--	--	10300	13	362
30	2700	3	22	--	--	--	9870	12	320
31	2900	1	7.8	--	--	--	9700	19	502
TOTAL	101830	--	599.3	135020	--	1752.5	453390	--	57760

TABLE 20. INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE ANALYSES, KOOTENAI R. NR. REXFORD, MONT., 1968 - 1971

DATE	TIME	TEMPER-ATURE °C 00010	DIS-CHARGE CFS 00060	SUS-PENDED SEDI-(MG/L) 80154	SUS-PENDED SEDI-MENT DIS-(T/DAY) 80155	SUS. SED. FALL DIAM. % FINER .004 MM 70338	SUS. SED. FALL DIAM. % FINER .016 MM 70340	SUS. SED. FALL DIAM. % FINER .062 MM 70342	SUS. SED. FALL DIAM. % FINER .125 MM 70343	SUS. SED. FALL DIAM. % FINER .250 MM 70344	SUS. SED. FALL DIAM. % FINER .500 MM 70345	SUS. SED. FALL DIAM. % FINER 1.00 MM 70346
Jun 07, 1968	1300	9.0	42700	169	19500	11	48	87	92	98	100	--
Apr 25, 1969	0750	11.0	34500	366	34100	21	46	79	91	100	--	--
May 12, 1969	1320	11.0	47100	485	61700	14	38	76	88	98	100	--
Jun 09, 1969	1300	12.0	56300	225	34200	21	40	76	88	99	100	--
Jun 03, 1970	1345	13.0	34600	141	13200	14	34	79	92	100	--	--
May 14, 1971	1300	7.0	60100	824	134000	13	36	76	91	98	100	--
Jun 02, 1971	1200	8.5	53100	173	24800	--	--	77	88	99	100	--

TABLE 21. INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE ANALYSES, KOOTENAI R. BELOW LIBBY DAM NR. LIBBY, MONT. 1968 - 1971

DATE	TIME	TEMPER-ATURE °C 00010	DIS-CHARGE CFS 00060	SUS-PENDED SEDI-(MG/L) 80154	SUS-PENDED SEDI-MENT DIS-(T/DAY) 80155	SUS. SED. FALL DIAM. % FINER .004 MM 70338	SUS. SED. FALL DIAM. % FINER .016 MM 70340	SUS. SED. FALL DIAM. % FINER .062 MM 70342	SUS. SED. FALL DIAM. % FINER .125 MM 70343	SUS. SED. FALL DIAM. % FINER .250 MM 70344	SUS. SED. FALL DIAM. % FINER .500 MM 70345	SUS. SED. FALL DIAM. % FINER 1.00 MM 70346
May 27, 1968	1450	10.0	37100	104	10400	15	39	80	89	99	100	--
Jun 06, 1968	1230	9.0	53100	371	53200	14	44	79	88	97	99	100
Apr 25, 1969	1320	7.0	31900	615	53000	20	42	70	84	100	--	--
May 14, 1969	1115	11.0	53700	516	74800	15	39	72	86	99	100	--
May 21, 1969	1400	10.0	35800	76	7350	15	40	71	83	98	100	--
Jun 04, 1970	1830	10.5	41600	302	33900	11	30	70	86	99	100	--
May 14, 1971	1800	7.0	58000	683	107000	18	47	87	94	99	100	--
Jun 01, 1971	1330	9.0	57000	199	30600	19	46	85	94	99	100	--

TABLE 22. INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE ANALYSES, KOOTENAI R. NR. COPELAND, ID., 1967 - 1971

DATE	TIME	TEMPER-ATURE °C 00010	DIS-CHARGE CFS 00060	SUS-PENDED SEDI-(MG/L) 80154	SUS-PENDED SEDI-MENT DIS-(T/DAY) 80155	SUS. SED. FALL DIAM. % FINER .004 MM 70338	SUS. SED. FALL DIAM. % FINER .016 MM 70340	SUS. SED. FALL DIAM. % FINER .062 MM 70342	SUS. SED. FALL DIAM. % FINER .125 MM 70343	SUS. SED. FALL DIAM. % FINER .250 MM 70344	SUS. SED. FALL DIAM. % FINER .500 MM 70345	SUS. SED. FALL DIAM. % FINER 1.00 MM 70346
May 30, 1967	1120	10.0	70400	192	36500	17	41	66	82	97	100	--
Jun 05, 1968	1100	10.0	75300	660	134000	18	48	86	97	100	--	--
Jun 08, 1969	1100	12.0	82300	496	110000	16	43	72	91	99	100	--
Jun 05, 1970	1150	14.0	59500	179	28800	18	45	80	96	100	--	--

Table 23 Suspended Sediment Concentrations, Time-Weighed Means, Oct 67 - Mar 72

Year	Month	Rexford (Sta. 1) mg/l	Below Dam (Sta. 3) mg/l	Copeland (Sta. 9) mg/l
1967	Oct	12	31	-
	Nov	7	12	3
	Dec	19	18	5
1968	Jan	9	27	3
	Feb	12	20	7
	Mar	15	12	-
	Apr	8	9	9
	May	121	166	88
	Jun	179	257	153
	Jul	50	51	-
	Aug	12	13	-
	Sep	9	8	5
	Oct	5	7	3
	Nov	7	7	4
	Dec	9	12	4
1969	Jan	9	-	3
	Feb	10	-	4
	Mar	12	-	8
	Apr	77	132	104
	May	204	267	196
	Jun	165	286	165
	Jul	40	50	43
	Aug	8	11	11
	Sep	7	8	8
	Oct	6	5	3
	Nov	5	6	4
	Dec	6	4	4
1970	Jan	9	6	3
	Feb	8	3	5
	Mar	7	8	9
	Apr	6	7	8
	May	88	86	94
	Jun	76	96	89
	Jul	14	11	9
	Aug	9	10	5
	Sep	9	8	2
	Oct	5	6	4
	Nov	8	4	3
	Dec	9	13	3
1971	Jan	20	9	3
	Feb	11	18	17
	Mar	9	6	5
	Apr	57	52	39
	May	243	239	242
	Jun	180	143	162
	Jul	44	45	30
	Aug	15	13	9
	Sep	8	12	4
	Oct	-	7	5
	Nov	-	7	3
	Dec	-	8	2
1972	Jan	-	3	2
	Feb	-	5	5
	Mar	-	20	38

Table 24. Turbidity Determinations For The Kootenai River Below Libby Dam, 1968

Formazin Turbidity Units (00076)

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1			5	6	38	175	27	3	3	5	3	2
2			7	5	37	170	26	6	3	5	4	3
3			5	5	20	172*	33	18	3	4	3	3
4			5	4	17	174*	38	17	3	3	4	4
5			6	4	14	175	36	17	3	3	3	3
6			7	4	12	84	37	19	3	3	3	3
7			11	3	13	51	38	20	3	2	4	3
8			12	3	16	51	37	18	3	3	3	3
9			11	3	13	52	38	14	3	3	3	13
10			5	4	13	49	17	4	4	3	3	17
11			5	4	12	59	20	3	4	3	3	15
12			5	4	12	58	20	3	4	4	3	15
13			4	4	47	60	19	2	3	3	3	15
14			4	4	47	57	20	3	4	3	2	16
15			4	4	63	34	22	3	3	4	3	6
16			4	3	38	33	12	3	4	3	3	6
17			4	4	38	26	12	3	4	3	3	6
18			5	3	57	28	12	3	4	3	2	6
19			5	3	63	33	12	3	4	3	3	6
20			5	4	61	33	9	3	4	3	3	5
21			3	4	73	32	13	4	4	4	4	6
22			3	4	80	34	6	4	5	4	3	6
23			4	4	120	32	6	4	4	4	3	4
24			4	4	74	36	4	3	4	3	3	4
25			3	4	72	26	6	3	4	3	4	4
26			4	4	44	37	5	4	4	3	4	7
27			5	4	43	26	4	4	4	2	2	7
28			5	5	36	35	5	4	4*	3	2	7
29			5	5	37	34	5	3	4*	3	3	5
30			5	9	48	24	5	3	5*	3	2	5*
31			5		38		4	3		4		5*
Mean			5	4	42	63*	18	7	4*	3	3	7*

*Estimated

Table 25. Turbidity Determinations For The Kootenai River Below Libby Dam, 1969

Formazin Turbidity Units (00076)

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1				21	31	54	93	2	2	6	2	2
2				18	24	42	36	2	2	12	2	2
3				23	23	45	33	2	2	10	4	2
4				19	18	75	35	4	2	11	3	1
5				18	17	115	29	6	2	4	5	2
6				21	16	130	35	4	2	4	5	1
7				33	17	130	37	4	2	4	4	2
8				44	32	110	36	4	2	4	3	1
9				33	36	74	27	4	2	4	3	1
10				32	53	71	27	4	2	4	3	11
11				36	98	68	22	4	2	4	2	8
12				33	120	50	22	4	2	2	2	2
13				33	130	46	22	3	2	2	2	3
14				33	135	39	18	4	2	3	2	3
15				33	150	35	19	4	2	3	2	3
16				24	130	32	18	4	2	3	2	2
17			14	24	77	27	19	5	2	3	2	3
18			18	35	63	26	16	4	2	3	3	2
19			20	52	52	31	14	4	2	3	2	2
20			18	42	47	24	15	4	2	4	2	2
21			17	29	42	75	6	4	3	4	2	2
22			12	21	37	69	5	3	3	3	2	2
23			10	20	33	64	5	4	3	2	2	2
24			12	67	43	81	5	2	3	3	2	3
25			7	155	80	58	4	2	11	2	2	2
26			15	64	110	52	4	3	12	3	2	3
27			12	75	130	53	4	2	10	2	2	2
28			20	39	115	48	5	4	11	2	2	2
29			15	27	83	48	5	4	11	3	2	2
30			13	29	59	47	4	3	12	3	2	2
31			23		82		4	2		3		2*
Mean				38	67	61	20	4	4	4	2	3

*Estimated

Table 26. Turbidity Determinations For The Kootenai River Below Libby Dam, 1970

Formazin Turbidity Units (00076)

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2	2	2	2	13	53	7	7	4	4	2	4
2	1	2	2	3	11	57	5	5	4	3	3	3
3	1	1	2	3	17	63	4	5	4	4	2	4
4	1	1	1	5	26	57	4	5	4	3	3	3
5	1	2	2	4	18	83	5	4	3	3	2	4
6	2	1	2	4	30	80	5	5	3	3	2	4
7	1	1	1	5	31	80	4	5	3	4	3	3
8	4	1	4	2	28	80	3	3	3	4	3	6
9	3	1	4	3	27	54	4	4	3	3	2	3
10	4	1	2*	2	27	51	3	4	2	3	3	3
11	2	2	5	3	13	47	4	4	2	3	2	4
12	2	2	2	2	15	28	5	5	2	3	2	3
13	2	2	2	3	17	25	4	5	2	4	2	3
14	2	2	2	2	15	27	3	4	3	4	2	3
15	1	2	2	1	59	26	3	5	2	4	2	2
16	1	2	2*	2	64	68	3	3	3	4	2	4
17	1	2	2	2	62	73	4	4	3	4	3	4
18	1	2	2	3	64	74	3	4	4	4	3	3
19	1	2	2	3	38	68	3	5	5	4	3	3
20	1	3	2	3	39	27	3	4	4	3	3	6
21	2	3	2	3	35	23	3	3	3	4	3	7
22	1	3	2*	4	39	22	3	3	3	4	2	5
23	1	3	2	4	44	23	3	2	3	3	2	5
24	5	3	2	2	41	20	4	3	2	3	2	3
25	2	4	2	3	43	17	4	4	3	3	3	3
26	1	2	2	2	52	19	4	5	3	3	4	2
27	2	2	3	2	63	19	7	4	4	3	4	2
28	1	2	3*	3	63	16	4	4	6	3	2	3
29	1		3	1	27	16	4	4	4	3	2	3
30	1		2	3	24	17	4	3	3	3	2	3
31	1		2		25		5	3		3		4
Mean	2	2	2	3	35	44	4	4	3	3	2	4

*Estimated

Table 27. Turbidity Determinations For The Kootenai River Below Libby Dam, 1971

Formazin Turbidity Units (00076)

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2	24	5	5	25	83	28	8	4	5	3	4
2	2	22	6	6	20	77	29	7	5	5	4	2
3	2	11	4	5	39*	67	27	3	6	4	4	3
4	2	11	3	4	50*	62	23	4	8	3	5	8
5	3	8	3	8	64*	68	23	4	5	3	4	3
6	4	9	3	8	70*	98	22	3	7	3	5	2
7	3	3	4	9	72*	105	24	3	3	2	3	3
8	3	4	3	13	69	103	22	3	5	3	3	5
9	3	6	3	21	59	100	24	3	7	4	4	8
10	3	4	2	22	64	97	22	5	7	3	3	4
11	3	10	4	16	60	86	21	4	6	3	2	4
12	3	10	4	15	64	66	28	3	4	3	2	3
13	2	10	4	12	86	50	27	2	4	3	4	4
14	3	10	3	12	140	49	24	3	3	3	3	2
15	5	17	3	13	135	55	18	4	5	2	4*	2*
16	3	18	2	11	94	52	19	3	4	3	4	2
17	3	12	3	15	53	44	16	3	3	3	3	3
18	5	14	3	16	45	40	21	4	5	3	4	3
19	5	13	3	11	32	37	17	3	4	3	3	2
20	5	11	3	13	27	35	18	3	3	3	5	3
21	4*	6	3	24	23	32	19	2	3	3	3	3
22	3*	7	3	28	21	37	22	4	5	4	4	3
23	3	6	3	43	27	46	22	4	6	3	3	2
24	4	7	3	40	29	63	21	3	5	4	5	2
25	4	8	4	71	47	73	22	4	5	3	4	2
26	3	7	4	76	67	84	18	3	4	3	4	2
27	3	6	4	33	74	72	18	2	3	3	3	2
28	4	4	4	33	100	47	15	3	3	4	3	3
29	6		3	23	160	51	15	3	4	8	3	1
30	7		5	23	125	37	14	5	4	4	3	3
31	4		5		98		7	7		4		3
Mean	4*	10	4	21	66*	64	21	4	5	3	4*	3*

*Estimated

Table 28. Turbidity Determinations For The Kootenai River Below Libby Dam, 1972

Formazin Turbidity Units (00076)

DATE	JAN	FEB	MAR
1	2	1	17
2	2	2	17
3	2*	2	11
4	2*	2	8
5	2*	2	8
6	2*	2	9
7	2*	2	10
8	2	2	9
9	3	2	9
10	3*	1	9
11	3*	2	13
12	2*	2	20
13	2*	2	15
14	2*	2	18
15	2	2	16
16	2	3	20
17	2	3	20
18	2	3	25
19	2	3	25
20	1	5	27
21	3	3	29
22	2	3	30
23	3	2	31
24	2	3	33
25	2	3	30
26	3	3	25
27	3	3	22
28	3	4	23
29	3	17	22
30	3		27
31	3		29
Mean	2*	3	20

*Estimated

Table 29. Miscellaneous Turbidity Determinations for the Kootenai River Near Rexford, 1968

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
					Formazin Turbidity Units (00076)							
1											4	
2												
3					16							
4												
5												
6												
7												
8												
9				3				5	5			
10												
11										2		
12												
13						41						
14												
15												
16												
17												
18												
19												
20												
21												
23												
24									4			
25											4	
26												
27												
28												
29												
30												
31												

Table 30. Miscellaneous Turbidity Determinations for the Kootenai River at Warland, 1968.

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
					Formazin Turbidity Units (00076)							
1					17		25			4	3	
2								5				
3					26							
4				9					3			
5				4								
6												
7						57						4
8				6			38	12				5
9												
10						51			3			4
11										2		
12							24					4
13					25	48						4
14												
15							21					
16					47							4
17				3						2		
18						26						
19							13					
20												
21					54							
22			4				13					
23												
24					98	25						
25									5			
26							13					
27												
28					33	47						
29							6			3		
30												
31					40							

Table 31. Miscellaneous Turbidity Determinations for the Kootenai River Below Libby Dam, 1968.

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
					Formazin Turbidity Units (00076)							
1							27					
2								5				
3									3			
4				11								
5												
6			4									
7						52						4
8				5			36	14				
9					11							4*
10						48			2			23*
11			3	12								225*
12							23					25*
13					20							20*
14												
15							22					
16					48			3				8
17												
18			3	3		25						4
19				3			12					5
20												
21					49							
22			5				12					
23												
24					94	28						
25			3									
26				4			6					
27					34							
28						43						
29							6					
30				4								
31					40							

*Maximums

Table 32. Miscellaneous Turbidity Determinations for the Kootenai River at Libby, 1968.

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
					Formazin Turbidity Units (00076)							
1				10	28		26					
2								6		6		
3					37				3			
4												
5				8								
6			13									
7						68						9
8				10			35					
9					14			16				7*
10						43			5			16*
11				6								125*
12							25					55*
13					25							24*
14												
15							17					
16					47			6		6		
17												
18			3	6		25						
19							13					10
20												
21					45							
22							8					
23												
24					97	31						
25												
26				4			6	5				
27					34							
28						42						
29							5			8		
30				12								
31					43							

*Maximums

Table 33. Turbidity Determinations for the Kootenai River During Second-stage Diversion, 7-19 December 1968.

Date	Warland (Sta. 2) Time	Warland (Sta. 2) FTU	Below Dam (Sta. 3) Time	Below Dam (Sta. 3) FTU	Libby (Sta. 7) Time	Libby (Sta. 7) FTU
	Formazin Turbidity Units (00076)					
Dec 7	1015	4	0945	4	0845	9
9			0845	3	0720	4
	1515	5	1630	4	1700	7
10			0810	4	0730	9
	1205	4	1305	4	1335	8
			1400	4		
			1545	4	1605	8
			1830	6	1800	8
			2045	8	2000	9
			2240	23	2205	16
11			0035	36	0000	13
			0230	48	0200	13
			0425	53	0400	13
			0615	35	0545	17
			0745	28	0805	25
			1025	225	1000	38
			1230	130	1200	45
					1430	34
			1555	62	1625	43
			1830	48	1800	115
			2045	41	2015	125
			2145	41	2215	91
			2345	20		
12					0005	55
			0315	12	0230	24
			0445	12	0415	22
			0705	12	0630	22
			0900	25	0830	28
			1230	24	1205	15
	1420	5	1830	20	1800	25
13			0040	20	0005	24
			0630	8	0600	16
	1030	4	1230	8	1200	13
16	0935	4	0905	8		
17						
18			0845	4		
19			1000	5	0925	10

Table 34. Turbidity Determination for the Kootenai River During Drainage of Contractor's Settling Pond, 25 - 26 November 1969.

Date	Time	Warland (Sta 2)	Below Dam (Sta 3)	Libby (Sta 7)
		Formazin Turbidity Units (00076)		
Nov 25	1555		2	
	1700		47	
	1750			16
	1810		61	
	1915	2		
	2000		25	
	2030			12
	2115	2		
	2200		12	
	2230			11
	2315	2		
	2400		10	
Nov 26	0100			41
	0130		11	
	0205			43
	0310			36
	0335		17	
	0435	4		
	0545			20
	0835			17
	0900		2	
	1100		2	
	1300		2	
	1430	2		
	1500		2	
	1540			14

TABLE 35.1

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

12301933 - Kootenai River Below Libby Dam, Near Libby, MT

WATER YEAR ENDING SEPT. 30, 1968

CONDUCTIVITY (MICROMHOS AT 25 DEG. C), RANDOM (INSTANTANEOUS)

DAY	1967 OCT	NOV	DEC	1968 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	410	446	471	485	448	428	331	216	197	237	338
2	---	399	436	477	480	457	405	327	203	199	243	338
3	399	389	456	483	481	454	404	278	202	197	245	338
4	396	297	458	492	482	457	437	278	202	197	245	338
5	402	296	437	486	482	441	435	277	214	198	251	348
6	368	290	452	485	482	431	437	272	203	199	258	348
7	372	293	436	486	479	419	416	275	207	195	260	349
8	391	301	437	477	477	422	368	273	213	199	256	350
9	391	302	441	474	463	424	448	297	212	196	258	349
10	397	305	423	469	460	442	445	300	209	210	263	348
11	398	409	442	483	463	440	445	300	205	210	245	342
12	405	407	440	485	482	440	416	296	203	209	245	345
13	394	396	447	486	485	434	415	229	202	209	289	348
14	385	416	487	488	484	435	418	231	203	210	289	348
15	389	415	497	459	487	444	401	235	200	222	289	348
16	375	414	486	463	504	446	401	228	225	249	289	348
17	368	416	490	461	505	445	431	228	225	249	289	356
18	377	409	510	486	479	435	435	218	209	248	289	287
19	378	414	511	485	479	429	430	223	206	247	323	284
20	372	415	509	484	488	430	429	225	207	249	323	284
21	372	399	507	440	483	439	429	215	207	248	323	284
22	381	401	505	441	475	449	430	210	207	231	323	284
23	385	404	523	483	458	439	458	202	207	231	325	284
24	405	403	525	486	461	439	464	208	204	230	325	284
25	348	405	485	477	460	444	446	213	203	230	325	304
26	350	407	474	477	461	428	458	216	204	230	332	277
27	350	432	474	445	440	413	456	225	204	232	332	279
28	349	445	484	473	450	414	415	216	212	244	332	277
29	393	442	465	475	452	408	414	214	207	243	340	277
30	390	445	461	475	---	410	391	207	205	243	340	277
31	398	---	467	484	---	412	---	213	---	241	340	---
MONTH	382	386	471	475	475	434	427	247	208	222	291	319
YEAR	361											

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

TABLE 35.2

12301933- Kootenai River Below Libby Dam, Near Libby, MT

WATER YEAR ENDING SEPT. 30, 1969

CONDUCTIVITY (MICROMHOS AT 25 DEG. C) , RANDOM (INSTANTANEOUS)

DAY	1968 OCT	NOV	DEC	1969 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	270	271	306	---	---	---	301	228	204	215	261	311
2	270	269	303	---	---	---	303	227	204	227	261	293
3	277	271	303	---	---	---	289	232	204	227	264	299
4	269	269	303	---	---	---	289	238	192	248	269	299
5	269	269	306	---	---	---	289	242	191	210	269	311
6	270	276	306	---	---	---	273	240	188	225	269	311
7	269	274	309	---	---	---	259	227	186	217	269	308
8	271	269	312	---	---	---	255	227	179	224	274	304
9	271	283	309	---	---	---	255	225	188	233	279	301
10	270	283	306	---	---	---	257	210	192	231	279	305
11	270	271	306	---	---	---	253	203	190	231	284	308
12	270	286	303	---	---	---	248	207	194	229	282	310
13	270	274	306	---	---	---	244	184	204	227	282	313
14	270	271	306	---	---	---	248	184	200	229	282	315
15	270	271	306	---	---	---	248	203	205	231	282	317
16	270	278	303	---	---	---	244	203	215	233	282	314
17	270	286	306	---	---	323	240	204	214	246	282	311
18	270	288	306	---	---	320	236	206	215	240	284	307
19	280	291	318	---	---	317	248	207	203	250	284	300
20	283	291	315	---	---	319	238	206	204	255	284	3C6
21	280	291	309	---	---	317	236	204	194	255	282	308
22	280	291	312	---	---	317	236	204	181	267	282	311
23	283	291	312	---	---	322	226	196	188	252	284	311
24	280	291	312	---	---	326	204	190	188	255	287	307
25	280	291	322	---	---	329	216	179	190	25C	290	301
26	281	286	339	---	---	330	213	174	186	252	290	298
27	280	291	339	---	---	33C	221	179	188	252	284	298
28	280	288	339	---	---	314	224	179	189	246	282	298
29	277	291	---	---	---	310	221	182	189	252	284	298
30	277	291	---	---	---	310	226	192	188	250	284	298
31	273	---	---	---	---	299	---	184	---	262	290	---
MONTH	274	281	312	---	---	---	248	205	195	239	279	3C6
YEAR	263											

NOTE: NUMBER OF MISSING DAYS OF RECORD EXCEEDED 20% OF YEAR

TABLE 36.1

KOOTENAI RIVER NEAR REXFORD, MONT.

DATE FROM TO	TIME OF DAY	00010 WATER TEMP CENT	00060 STREAM FLOW CFS	00070 TURB JKSN JTU	00080 COLOR PT-CO UNITS	00095 CNDUCTVY AT 25 C MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00310 BOD 5 DAY MG/L	00400 PH SU	00405 CO2 MG/L
67/06/29	18 00	12.2	56200		5	210				7.70	
67/07/27	11 30	16.1	17500			254				7.60	
67/09/08	12 00	15.0	6680		3	354	10.0			7.30	
67/10/11	12 00		4540		3	421				7.70	
67/11/07	14 00		3830		4	308				7.70	
67/12/19	12 50		2200		3	522				8.00	
68/01/29	17 30	0.0	2200								
68/03/19	15 15	6.0	3540		3	469				7.90	
68/04/22	17 15	10.0	3410		3	489				7.70	
68/05/22	17 50	10.0	35800		12	216				7.60	
68/06/17	12 00	12.0	29600		2	242				7.30	
68/07/24	14 15	15.0	15900		5	226				7.50	
68/08/29	12 00	14.0	9220		1	325	9.0			7.70	
68/10/04	16 15	9.0	7320		3	281				7.70	
68/11/06	15 30	4.0	5580		1	285				7.50	
68/12/02	16 00	2.0	4090		3	313				7.60	
69/01/06	13 30	0.0	3300		1	340	12.0			7.60	
69/02/07	15 00	0.0	2800		1	341	11.0			8.00	
69/03/06	13 45	1.0	2620		2	341				7.90	
69/04/01	13 15	6.0	4500		4	353				7.70	
69/05/02	11 45	8.0	17900		4	248				8.00	
69/06/09	13 00	12.0	56300	93.0	5	218				7.70	
69/07/09	14 00	14.0	30700	32.0	4	227				7.60	
69/08/07	15 00	15.0	11400	2.0	3	268				7.40	
69/09/04	12 30	15.0	6130	4.0	5	314				7.90	
69/10/16	09 30	4.0	5230	2.0	3	303	11.2	93		8.20	
69/11/05	14 15	6.0	4030	1.0	1	325	11.6	102		7.90	
69/12/01	13 00	0.0	2930	1.0	2	348	12.8	96		7.20	
70/01/05	15 00	0.0	1300	1.0	7	411	12.6	94		7.80	
70/02/02	10 30	0.0	2570	1.0	2	367	12.8	96		7.80	
70/03/05	13 40	0.5	2390	3.0	2	373	13.0	98		7.80	
70/04/08	12 30	6.0	3680	5.0	5	354	11.4	100		8.30	
70/05/08	12 30	8.5	16000	43.0	14	233	10.3	96		7.70	
70/06/03	12 30	13.0	31800	30.0	15		9.8	101		7.40	
70/07/07	10 00	16.5	17200	3.0	6	224	8.4	94		8.30	
70/08/05	13 30	18.0	7990	1.0	2	260	8.8	101		8.20	
70/09/02	11 15	16.5	4910	1.0	3	266	9.4	105		8.00	
70/10/22	17 15	5.5	4000	2.0	0	345	11.6	100		7.80	3.4
70/11/13	14 00	4.0	3310	2.0	3	335	11.9	99		7.80	3.8
70/12/08	11 00	0.0	3800	1.0	5		12.5	93		7.40	10.0
71/01/18	11 30	0.0	2500	0.0	4	380	11.7	87		7.30	13.0
71/02/18	12 00	0.5	3740	3.0	0	329	12.9	98		7.40	8.6
71/03/17	10 30	2.0	2700	3.0		370	12.5	99		8.20	1.5
71/04/14	09 00	6.0	4450	4.0	5	340	12.0	105		8.00	2.4
71/05/20	12 00	7.0	25800	20.0	10	245	12.0	108		7.70	3.7
71/06/09	10 30	8.0	63900	20.0	10	195	11.4	105		7.80	2.7
71/07/15	10 30	12.0	25200	7.0	5	215	11.4	105		7.90	2.1
71/08/10	10 30	17.5	13900	3.0	8	215	9.4	107		8.10	1.5
71/09/07	08 00	11.5	7550	4.0	10	280	10.0	100		7.00	20.3
71/10/14	12 00	7.0	5280	4.0	5	315	11.6	104		8.10	1.9
71/11/11	10 00	1.5	4640	3.0	5	340	12.8	100		8.10	2.1
71/12/16	12 30	0.0	2500	2.0	7	380	13.4	100		8.20	1.8
72/01/10	10 30	0.0	2500	1.0	5	360	13.0	97		8.10	2.1
72/02/07	10 30	0.0	2500	2.0	3	375	11.8	88		7.80	4.0
72/03/14	09 00	3.0	5100	15.0	0	335	12.0	97		8.30	1.2

TABLE 36.2 CHEMICAL DATA KOOTENAI RIVER NEAR REXFORD, MONT.

DATE FROM TO	TIME OF DAY	70300 RESIDUE DISS-180 C MG/L	70301 DISS SOL SUM MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L	00445 CO3 ION CO3 MG/L	00900 TOT HARD CA CO3 MG/L	00902 NC HARD CA CO3 MG/L
67/06/29	18 00	123	117	89	109	0	111	22
67/07/27	11 30	147	144	92	112	0	128	36
67/09/08	12 00	219	212	108	132	0	174	66
67/10/11	12 00	263	259	118	144	0	220	102
67/11/07	14 00	188	176	119	145	0	156	37
67/12/19	12 50	349	336	135	165	0	273	137
68/03/19	15 15	303	295	123	150	0	243	120
68/04/22	17 15	336	305	125	152	0	246	122
68/05/22	17 50	125	126	80	98	0	106	25
68/06/17	12 00	152	137	95	116	0	117	22
68/07/24	14 15		128	93	114	0	110	17
68/08/29	12 00	208	190	100	122	0	158	58
68/10/04	16 15	163	162	104	127	0	144	39
68/11/06	15 30	178	163	113	138	0	142	28
68/12/02	16 00	161	175	122	149	0	145	23
69/01/06	13 30	217	198	134	164	0	170	36
69/02/07	15 00	212	196	130	158	0	167	37
69/03/06	13 45	215	199	131	160	0	172	41
69/04/01	13 15	207	202	130	158	0	174	45
69/05/02	11 45	153	139	105	128	0	123	18
69/06/09	13 00	122	118	102	125	0	103	1
69/07/09	14 00	131	129	102	124	0	113	11
69/08/07	15 00	155	152	115	140	0	131	16
69/09/04	12 30	183	174	130	158	0	151	21
69/10/16	09 30	189	177	126	153	0	152	26
69/11/05	14 15	205	188	128	156	0	159	32
69/12/61	13 00	212	205	139	170	0	175	35
70/01/05	15 00	252	229	158	193	0	194	35
70/02/02	10 30	223	212	137	167	0	177	40
70/03/05	13 40	224	216	137	168	0	182	45
70/04/08	12 30	218	204	134	163	0	172	38
70/05/08	12 30	151	131	95	116	0	116	20
70/06/03	12 30	118	111	86	105	0	97	10
70/07/07	10 00	130	124	95	116	0	108	13
70/08/05	13 30	158	145	109	133	0	132	23
70/09/02	11 15	183	157	110	134	0	142	32
70/10/22	17 15	190		111	135		160	
70/11/13	14 00	194		125	152		160	
70/12/08	11 00	210		130	158		170	
71/01/18	11 30	200	210	133	162	0	180	50
71/02/18	12 00	200		112	137		160	
71/03/17	10 30	228	140	125	152		180	
71/04/14	09 01	182		122	149		160	
71/05/20	12 00	112		95	116		110	
71/06/09	10 30	120		88	107		91	
71/07/15	10 30	116		85	104		100	
71/08/10	10 30	116	129	93	113		110	
71/09/07	08 00	150	158	104	127		130	9
71/10/14	12 00	182		118	144		150	
71/11/11	10 00	226	201	134	163		160	34
71/12/16	12 30	238		152	185		180	
72/01/10	10 30	212	206	132	161		170	38
72/02/07	10 30	224	216	130	158		170	36
72/03/14	09 00	170	188	125	152		160	32

TABLE 36.3 CHEMICAL DATA

KOOTENAI RIVER NEAR REXFORD, MONT.

DATE FROM TO	TIME OF DAY	00600 TOTAL N N MG/L	00605 ORG N N MG/L	00610 NH3-N TOTAL MG/L	00613 NO2-N DISS MG/L	00618 NO3-N DISS MG/L	00630 NO2&3NO3 N-TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P	00671 PHOS-DIS ORTHO MG/L P	00680 T ORG C C MG/L
67/10/11	12 00					0.00			0.630	0.570	
67/11/07	14 00					0.02			0.090	0.070	
67/12/19	12 50					0.02			0.940	0.920	
68/01/29	17 30								1.090	0.970	
68/03/19	15 15					0.05			0.580	0.560	
68/04/22	17 15					0.00			0.710	0.750	
68/05/22	17 50					0.00			0.450	0.390	
68/06/17	12 00					0.05			0.230	0.140	
68/07/24	14 15					0.00			0.380	0.340	
68/08/29	12 00					0.00			0.370	0.340	
68/10/04	16 15					0.02			0.170	0.160	
68/11/06	15 30					0.00			0.440	0.410	
68/12/02	16 00					0.02				0.190	
69/01/06	13 30					0.01					
69/02/07	15 00					0.00			0.180	0.160	
69/03/06	13 45					0.00			0.270	0.260	
69/04/01	13 15					0.00			0.030	0.010	
69/05/02	11 45		0.220	0.000		0.07			0.090	0.090	
69/06/09	14 15		0.380	0.080		0.06					
69/07/09	14 00	0.67	0.040	0.560	0.000	0.07			0.220	0.050	
69/08/07	15 00	0.81	0.520	0.280	0.010	0.00			0.340	0.050	
69/09/04	12 30	0.36	0.040	0.320	0.000	0.00			0.070	0.030	
69/10/16	09 30	0.19	0.080	0.000	0.010	0.11		0.150	0.080	0.050	
69/11/05	14 15	0.38	0.230	0.040	0.000	0.11		0.330	0.230	0.060	
69/12/01	13 00	0.32	0.090	0.050	0.000	0.18		0.140	0.130	0.080	
70/01/05	15 00	0.64	0.140	0.270	0.000	0.23		0.140	0.150	0.140	
70/02/02	10 30	0.42	0.070	0.100	0.000	0.25		0.050	0.040	0.040	
70/03/05	13 40	0.44	0.120	0.140	0.000	0.18		0.180	0.120	0.090	
70/04/08	12 30	0.33	0.120	0.020	0.020	0.17		0.150	0.110	0.090	
70/05/08	12 30	0.57	0.300	0.040	0.050	0.18		0.380	0.060	0.060	
70/06/03	12 30	0.35	0.160	0.050	0.000	0.12		0.410	0.070	0.050	
70/07/07	10 00	0.19	0.100	0.030	0.000	0.06		0.100	0.080	0.070	
70/08/05	13 30	0.14	0.080	0.040	0.020	0.00		0.100	0.070	0.060	
70/09/02	11 15	0.09	0.020	0.020	0.020	0.03		0.120	0.100	0.100	
70/10/22	17 15	0.47	0.160	0.070	0.020	0.22		0.190		0.190	2.0
70/11/13	14 00	0.43	0.110	0.090	0.020	0.20		0.380		0.350	9.0
70/12/08	11 00	0.58	0.180	0.110	0.010	0.28		0.280		0.200	4.0
71/01/18	11 30	0.09	0.000	0.000	0.000	0.09	0.1			0.010	3.0
71/02/18	12 00	0.41	0.020	0.190	0.000	0.20	0.2	0.300		0.100	1.0
71/03/17	10 30	0.61	0.140	0.370	0.000	0.10	0.1	0.260		0.160	6.0
71/04/14	09 00	0.52	0.160	0.260	0.000	0.10	0.1	0.150		0.030	5.0
71/05/20	12 00	0.37	0.220	0.050	0.000	0.10	0.1	0.200		0.080	2.0
71/06/09	10 30	0.36	0.010	0.240	0.000	0.11	0.1	0.300		0.060	4.0
71/07/15	10 30	0.24	0.140	0.070	0.000	0.03	0.03	0.040		0.010	10.0
71/08/10	10 30	0.25	0.090	0.110	0.000	0.05	0.05	0.050		0.010	14.0
71/09/07	08 00	0.26	0.090	0.080	0.000	0.09	0.1	0.110		0.030	1.0
71/10/14	12 00	0.29	0.130	0.030	0.000	0.10	0.1	0.180		0.010	5.0
71/11/11	10 00	0.46	0.000	0.360	0.000	0.17	0.2			0.080	0.0
71/12/16	12 30	0.45	0.120	0.140	0.000	0.19	0.2	0.220		0.170	
72/01/10	10 30	0.41	0.170	0.080	0.000	0.16	0.2	0.220		0.150	1.0
72/02/07	10 30	0.69	0.410	0.060	0.000	0.22	0.2	0.190		0.120	
72/03/14	09 00	0.59	0.240	0.149	0.000	0.20	0.2	0.159		0.060	0.5

TABLE 36.4 CHEMICAL DATA

KOOTENAI RIVER NEAR REXFORD, MONT.

DATE FROM TO	TIME OF DAY	00915 CALCIUM CA,DISS MG/L	00925 MGNSIUM MG,DISS MG/L	00930 SODIUM NA,DISS MG/L	00935 PTSSIUM K,DISS MG/L	00940 CHLORIDE CL MG/L	00945 SULFATE SO4-TOT MG/L	00950 FLUORIDE F,DISS MG/L	00955 SILICA DISOLVED MG/L
67/06/29	18 00	34.0	6.4	1.10	0.60	0.4	16	0.30	4.6
67/07/27	11 30	37.0	8.6	1.80	0.40	2	34	0.50	5.0
67/09/08	12 00	52.0	11.0	2.80	1.30	1	71	1.30	6.1
67/10/11	12 00	67.0	13.0	3.10	1.00	2	94	0.50	6.2
67/11/07	14 00	43.0	12.0	2.80	0.80	2	38	0.20	5.9
67/12/19	12 50	85.0	15.0	3.60	1.20	2	138	2.10	8.5
68/03/19	15 15	76.0	13.0	4.40	0.80	2	115	3.40	6.6
68/04/22	17 15	76.0	14.0	3.40	1.00	2	125	2.30	6.3
68/05/22	17 50	32.0	6.4	1.60	0.60	1	28	0.60	7.4
68/06/17	12 00	34.0	7.5	1.40	0.80	1	29	0.60	5.3
68/07/24	14 15	31.0	7.9	1.70	0.40	2	23	0.30	5.3
68/08/29	12 00	47.0	9.9	2.50	0.40	2	62	0.90	5.0
68/10/04	16 15	41.0	10.0	2.40	0.40	2	37	1.10	6.0
68/11/06	15 30	39.0	11.0	2.60	1.00	2	32	0.90	5.4
68/12/02	16 00	38.0	12.0	3.20	0.60	2	38	0.90	6.5
69/01/06	13 30	46.0	14.0	3.40	0.80	3	43	0.90	7.7
69/02/07	15 00	45.0	13.0	3.60	0.80	3	45	0.90	7.1
69/03/06	13 45	46.0	14.0	3.80	1.00	2	45	1.20	6.9
69/04/01	13 15	48.0	13.0	4.20	1.10	3	47	1.10	6.6
69/05/02	11 45	34.0	9.2	2.10	0.60	1	23	0.30	5.8
69/06/09	13 00	31.0	6.3	1.10	0.90	1	12	0.30	4.1
69/07/09	14 00	31.0	8.6	1.60	0.50	2	20	0.30	4.5
69/08/07	15 00	35.0	11.0	2.90	1.10	2	26	0.00	4.9
69/09/04	12 30	40.0	13.0	4.20	0.90	3	31	0.20	5.0
69/10/16	09 30	41.0	12.0	3.70	1.00	3	34	0.60	5.8
69/11/05	14 15	42.0	13.0	4.20	1.00	3	39	0.60	7.2
69/12/01	13 00	47.0	14.0	4.40	1.40	3	43	0.80	6.7
70/01/05	15 00	51.0	16.0	5.80	0.90	4	46	0.70	7.0
70/02/02	10 30	48.0	14.0	5.60	0.90	5	48	0.70	6.8
70/03/05	13 40	49.0	15.0	5.50	1.10	4	49	1.00	7.7
70/04/08	12 30	47.0	13.0	4.40	0.90	3	47	0.70	5.8
70/05/08	12 30	32.0	8.5	2.50	1.00	2	22	0.50	4.0
70/06/03	12 30	27.0	7.1	2.00	0.60	2	16	0.30	3.3
70/07/07	10 00	30.0	8.0	2.10	0.60	2	19	0.20	4.1
70/08/05	13 30	36.0	10.0	3.20	0.60	2	25	0.40	1.3
70/09/02	11 15	39.0	11.0	3.00	0.70	2	30	0.90	3.3
70/10/22	17 15	44.0	12.0	4.40	0.80	4	42	0.80	6.6
70/11/13	14 00	42.0	12.0	4.30	0.80	5	42	1.00	5.7
70/12/08	11 00	45.0	13.0	6.00	0.90	4	43	0.90	7.4
71/01/18	11 30	50.0	14.0	5.20	0.70	5	47	1.00	6.2
71/02/18	12 00	44.0	13.0	4.10	0.70	3	38	1.20	7.0
71/03/17	10 30	48.0	14.0	6.30	1.20	6	46	1.60	6.1
71/04/14	09 00	44.0	13.0	4.00	0.90	3	39	1.20	5.9
71/05/20	12 00	31.0	8.6	1.90	0.50	2	17	0.30	6.1
71/06/09	10 30	26.0	6.3	1.10	0.20	1	12	0.20	4.8
71/07/15	10 30	28.0	7.4	1.90	0.40	3	15	0.10	4.4
71/08/10	10 30	29.0	8.6	3.50	0.50	2	19	0.40	3.6
71/09/07	08 00	35.0	10.0	3.10	0.70	3	28	0.60	4.8
71/10/14	12 00	40.0	12.0	4.10	0.50	4	37	0.90	5.8
71/11/11	10 00	43.0	13.0	4.50	0.80	4	51	1.00	6.0
71/12/16	12 30	49.0	14.0	5.20	1.10	7	42	1.00	6.9
72/01/10	10 30	47.0	14.0	5.20	0.70	4	43	1.20	7.0
72/02/07	10 30	47.0	14.0	5.40	0.70	6	50	1.10	7.2
72/03/14	09 00	44.0	12.0	4.20	0.80	4	36	1.20	7.7

TABLE 36.5 CHEMICAL DATA

KOOTENAI RIVER NEAR REXFORD, MONT.

DATE FROM TO	TIME OF DAY	01000 ARSENIC AS,DISS UG/L	01002 ARSENIC AS,TOT UG/L	01005 BARIUM BA,DISS UG/L	01010 BERYLIUM BE,DISS UC	01020 BORON B,DISS UG/L	01022 BORON B,TOT UG/L	01025 CADMIUM CD,DISS UG/L	01027 CADMIUM CD,TOT UG/L	01030 CHROMIUM CR,DISS UG/L	01032 CHROMIUM HEX-VAL UG/L
69/06/29	18 00					0					
67/07/27	11 30					20					
67/09/08	12 00					10					
67/10/11	12 00					10					
67/11/07	14 00					0					
67/12/19	12 50					0					
68/03/19	15 15					10					
68/04/22	17 15					40					
68/05/22	17 50					0					
68/06/17	12 00					0					
68/07/24	14 15					0					
68/08/29	12 00					0					
68/10/04	16 15					0					
68/11/06	15 30					10					
68/12/02	16 00					0					
69/01/06	13 30					60					
69/02/07	15 00					50					
69/03/06	13 45					10					
69/04/01	13 15					0					
69/05/02	11 45					0					
69/06/09	14 15					0					
69/07/09	14 00					20					
69/08/07	15 00					10					
69/09/04	12 30					0					
69/10/16	09 30					10					
69/11/05	14 15					10					
69/12/01	13 00					31					
70/01/05	15 00					10					
70/02/02	10 30					17					
70/03/05	13 40					16					
70/04/08	12 30					11					
70/05/08	12 30					10					
70/06/03	12 30					45					
70/07/07	10 00					21					
70/08/05	13 30					40					
70/09/02	11 15					102					
70/10/22	17 15	10		0	0.00	0		0			0
70/11/13	14 00	0		0	0.00	50		0			0
70/12/08	11 00	10		0	0.00	0		0			0
71/01/18	11 30	10		0	0.00	20		0			0
71/02/18	12 00	10		320	10.00	0		0			0
71/03/17	10 30	10		130	2.00	0		0			0
71/04/14	09 00	0		300	2.00	10		0			0
71/05/20	12 00	0		100	0.00	0		0	1	0	0
71/06/09	10 30	0		0	0.00	30		0	1	0	0
71/07/15	10 30	0		100	0.00	10		0	< 1	0	0
71/08/10	10 30	0		100	0.00	0		0		0	0
71/09/07	08 00	0		50	0.00	10		0		0	0
71/10/14	12 00	0		300	10.00	0		0		0	1
71/11/11	10 00	1		100	0.00	0		0		0	0
71/12/16	12 30	8		0	0.00	20		0		0	0
72/01/10	10 30	5		0	0.00	10		1		0	0
72/02/07	10 30	0		0	0.00	20		0		0	0
72/03/14	09 00	2		0	0.00	20		0		0	0

KOOTENAI RIVER NEAR REXFORD, MONT.

TABLE 36.6 CHEMICAL DATA

DATE FROM TO	TIME OF DAY	01035 COBALT CO,DISS UG/L	01037 COBALT CO,TOTAL UG/L	01040 COPPER CU,DISS UG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01046 IRON FE,DISS UG/L	01049 LEAD PB,DISS UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01056 MANGNESE MN,DISS UG/L
67/07/27	11 30					20					
67/09/08	12 00					0					
67/10/11	12 00					10					
67/11/07	14 00					210					
67/12/19	12 50					20					
68/03/19	15 15					80					
68/04/22	17 15					60					
68/05/22	17 50					10					
68/06/17	12 00					130					
68/07/24	14 15					40					
68/08/29	12 00					0					
68/10/04	16 15						30				
68/11/06	15 30						30				
68/12/02	16 00						60				
69/01/06	13 30						240				
69/02/07	15 00						30				
69/03/06	13 45						60				
69/04/01	13 15						40				
69/05/02	11 45						90				
69/06/09	14 15						90				
69/07/09	14 00						90			28.0	
69/08/07	15 00						30				
69/09/04	12 30						40				
69/10/16	09 30						20				28.0
69/11/05	14 15						57				32.0
69/12/01	13 00						154				45.0
70/01/05	15 00						41				38.0
70/02/02	10 30						89				55.0
70/03/05	13 40						52				63.0
70/04/08	12 30						32				43.0
70/05/08	12 30						53				20.0
70/06/03	12 30						0				20.0
70/07/07	10 00						77				21.0
70/08/05	13 30						59				11.0
70/09/02	11 15						154				23.0
70/10/22	17 15	0		0			240	0			18.0
70/11/13	14 00	0		0			10	0			17.0
70/12/08	11 00	0		0			40	0			35.0
71/01/18	11 30	0		1			110	0			0.0
71/02/18	12 00	3		2			180	0			430.0
71/03/17	10 30	4		1			140	5			86.0
71/04/14	09 00	4		2			30	3			40.0
71/05/20	12 00	0	< 1	0	< 10	740	120	3	9	30.0	0.0
71/06/09	10 30	0	4	2	10	3300	40	5	27	150.0	40.0
71/07/15	10 30	2	< 1	1	< 10	340	20	1	3	10.0	47.0
71/08/10	10 30	0		1			20	0			30.0
71/09/07	08 00	0		1			20	0			10.0
71/10/14	12 00	1		0			20	0			10.0
71/11/11	10 00	0		0			30	0			30.0
71/12/16	12 30	0		6			10	8			30.0
72/01/10	10 30	1		0			20	5			20.0
72/02/07	10 30	0		1			30	0			79.0
72/03/14	09 00	0		0			30	2			58.0

TABLE 36.7 CHEMICAL DATA — KOOTENAI RIVER NEAR REXFORD, MONTANA

DATE FROM TO	TIME OF DAY	01060 MOLY MO,DISS UG/L	01065 NICKEL NI,DISS UG/L	01075 SILVER AG,DISS UG/L	01080 STRONTUM SR,DISS UG/L	01082 STRONTUM SR,TOT UG/L	01085 VANADIUM V,DISS UG/L	01090 ZINC ZN,DISS UG/L	01092 ZINC ZN,TOT UG/L
70/10/22	17 15	0	1	0.0	220		0.2	40	
70/11/13	14 00	1	J	1.0	220		0	40	
70/12/08	11 00	2	0	1.0	230		0	60	
71/01/18	11 30	0	1	0.0	180		0	60	
71/02/18	12 00	0	0	1.0	240		1	73	
71/03/17	10 30	12	3	1.0	300		1	78	
71/04/14	09 00	0	0	1.0	270		0	30	
71/05/20	12 00	0	0	0.0	160		0	20	30
71/06/09	10 30	0	0	0.0	30		0	0	< 10
71/07/15	10 30	4	3	0.0	140		0	8	< 10
71/08/10	10 30	0	14	0.0	110		0	10	
71/09/07	08 00	3	2	0.0	180		0.3	30	
71/10/14	12 00	6	3	0.0	220		0	10	
71/11/11	10 00	0	0	0.0	190		0	50	
71/12/16	12 30	2	15	0.0	280		0.4	20	
72/01/10	10 30	0	5	0.0	280		0.5	30	
72/02/07	10 30	2	4	0.0	240		0	30	
72/03/14	09 00	0	3	1.0	50		1	20	

TABLE 36.8 CHEMICAL DATA — KOOTENAI RIVER NEAR REXFORD, MONT.

DATE FROM TO	TIME OF DAY	01106 ALUMINUM AL,DISS UG/L	01130 LITHIUM LI,DISS UG/L	01145 SELENIUM SE,DISS UG/L	31501 TOT COLI MFIMENDO /100 ML	31503 TOT COLI MFDLENDO /100 ML	71890 MERCURY HG,DISS UG/L	71900 MERCURY HG,TOTAL UG/L	31503 TOT COLI MFDLENDO /100 ML	31616 FEC COLI MFM-FCBR /100 ML	38260 MBAS MG/L
70/10/22	17 15	100	0				0.0				0.00
70/11/13	14 00	100	0				0.0				0.01
70/12/08	11 00	100	0				0.0				0.01
71/01/18	11 30	200	0					0.0			0.07
71/02/18	12 00	400	10				0.0				0.00
71/03/17	10 30	100	0				0.1				
71/04/14	09 00	300	13				0.1				0.00
71/05/20	12 00	300	16				0.3	< 0.5			0.00
71/06/09	10 30	400	0				0.0				0.00
71/07/15	10 30	300	25				0.3	< 0.5			0.00
71/08/10	10 30	100	0				0.0				0.00
71/09/07	08 00	200	10				0.0				0.00
71/10/14	12 00	100	10				0.1				0.00
71/11/11	10 00	0	0				0.2				0.00
71/12/16	12 30	0	0				0.2				0.00
72/01/10	10 30	100	0				0.2				0.00
72/02/07	10 30	0	0				0.3				0.00
72/03/14	09 00	0	10				0.3				0.00

TABLE 37.1 CHEMICAL DATA

KOOTENAI RIVER BELOW LIBBY DAM

DATE FROM TO	TIME OF DAY	00010 WATER TEMP CENT	00060 STREAM FLOW CFS	00070 TURB JKSN JTU	00080 COLOR PT-CO UNITS	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00310 BOD 5 DAY MG/L	00400 PH SU	00405 CO2 MG/L
67/06/29	09 15	12.2	56800		5	208				7.70	
67/07/26	16 30		18200		3	266				7.10	
67/09/07	14 30	16.1	6930		2	356	11.0			7.20	
67/10/11	08 00	11.0	4790								
67/11/07	10 30	1.0	4330								
67/12/15	15 00		1950		6	511				7.60	
68/01/24	13 05	0.0	4100								
68/03/07	17 30	4.0	4330		4	448				7.80	
68/04/24	18 40	8.0	3690								
68/05/27	15 30	10.0	37200		10	230				7.60	
68/06/17	18 15	12.0	31000								
68/07/23	15 30		17500								
68/08/28	16 00	15.0	8300		1	339				7.80	
68/10/01	18 15	12.0	8260								
68/12/05	14 15	1.0	4650		3	309				7.60	
69/02/04	15 30	0.0	2900		1	331				8.00	
69/03/04	16 00	0.0	2700		2	335	11.0			7.90	
69/04/03	13 15	7.0	7500		3	297				7.70	
69/05/07	18 00	9.0	20900		7	232				8.20	
69/06/05	11 15	12.0	61000		3	199				7.80	
69/07/08	09 30	12.0	33500		3	233				7.40	
69/08/04	18 45	18.0	11800		4	269				7.70	
69/09/02	17 15	16.0	6400		5	303				8.00	
69/10/15	10 00	5.0	5550	1.0	5	303	11.6	98		8.20	
69/11/04	16 30	5.5	4340	2.0	1	321	11.6	100		8.10	
69/12/02	14 30	0.0	3000	2.0	4	351	13.6	101		7.40	
70/01/12	15 00	0.0	2300	2.0	5	373	12.6	93		8.00	
70/02/04	14 30	0.0	2700	1.0	3	340	12.8	95		7.40	
70/03/04	14 15	0.0	2400	1.0	2	372	13.4	99		8.00	
70/04/06	14 00	8.0	3080	2.0	10	362	11.4	104		8.30	
70/05/06	14 30	12.0	10800	32.0	15	245	9.3	94		7.70	
70/06/04	18 00	10.5	40700	58.0	10	190	9.2	89		7.40	
70/07/06	13 00	18.0	18100	3.0	10	224	8.4	96		8.00	
70/08/04	14 15	18.0	8650	2.0	2	262	9.4	108		8.10	
70/09/01	13 30	18.0	5340	2.0	2	277	9.0	103		8.00	
70/10/22	14 30	6.0	4220	2.0	2	345	11.2	97		7.50	6.9
70/11/16	12 45	3.5	3470	2.0	2	355	12.3	99		7.60	5.6
70/12/07	15 30	0.0	2950	1.0	3		13.7	102		7.20	16.0
71/01/19	09 30	0.0	2700	1.0	2		11.7	87		7.20	15.0
71/02/19	13 00	0.5	4900	15.0	1	290	12.7	95		7.90	2.7
71/03/18	10 00	2.0	3100	2.0	0	360	12.5	98		8.20	1.4
71/04/15	13 00	8.0	6000	5.0	5	315	11.8	108		8.10	1.8
71/05/19	12 00	7.5	31000	25.0	10	230	12.6	114		7.70	3.6
71/06/10	10 30	8.5	62000	75.0	20	195	12.4	115		7.80	2.7
71/07/14	12 00	12.5	26800	15.0	4	210	10.8	109		8.00	1.6
71/08/11	11 00	19.0	14300	2.0	5	240	10.2	119		8.20	1.1
71/09/08	12 30	12.5	7100	10.0	10	290	10.8	110		8.20	1.4
71/10/15	11 00	7.0	5580	3.0	5	315	12.0	107		7.80	3.5
71/11/12	12 00	2.5	4600	2.0	5	340	14.0	111		7.70	4.5
71/12/17	10 30	0.0	2600	3.0	5	360	14.6	108		7.90	3.5
72/[illegible]/05	12 00	0.0	2900	2.0	0	355	14.4	107		7.90	3.3
[illegible]/08	16 00	0.0	3000	2.0	3	370	13.8	102		7.90	3.3
72/03/13	12 00	3.5	4510	10.0	5	305	14.0	114		8.10	1.8
72/03/20	13 30	5.0	6740	25.0	40	265	13.8	117		7.90	2.4
72/03/27	10 30	5.0	2060	15.0	40	240	13.2	112		7.90	2.6

TABLE 37.2 CHEMICAL DATA

KOOTENAI RIVER BELOW LIBBY DAM

DATE FROM TO	TIME OF DAY	70300 RESIDUE DISS-180 C MG/L	70301 DISS SOL SUM MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L	00445 CO3 ION CO3 MG/L	00900 TOT HARD CACO3 MG/L	00902 NC HARD CACO3 MG/L
67/06/29	09 15	122	116		108	0	107	18
67/07/26	16 30	158	150		114	0	128	34
67/09/07	14 30	216	213		136	0	177	65
67/12/15	15 00	338	327		164	0	263	128
68/03/07	17 30	308	283		138	0	228	114
68/05/27	15 30	132	131		110	0	112	22
68/08/28	16 00	220	197		127	0	165	61
68/12/05	14 15	171	176		148	0	155	33
69/02/04	15 30	208	197		158	0	169	40
69/03/04	16 00	211	198		160	0	169	38
69/04/03	13 15	183	173		139	0	144	30
69/05/07	18 00	149	132		119	0	121	23
69/06/05	11 15	151	113		119	0	101	3
69/07/08	09 30	133	135		132	0	124	16
69/08/04	18 45	161	152		138	0	131	17
69/09/02	17 15	174	167		153	0	145	19
69/10/15	10 00	178	173		150	0	154	31
69/11/04	16 30	200	181		148	0	154	32
69/12/02	14 30	208	205		170	0	175	36
70/01/12	15 00	226	219		182	0	184	35
70/02/04	14 30	209	209		165	0	176	41
70/03/04	14 15	222	219		165	0	184	49
70/04/06	14 00	222	203		160	0	168	37
70/05/06	14 30	152	140		120	0	122	23
70/06/04	18 00	118	97		94	0	82	5
70/07/06	13 00	139	130		117	0	116	20
70/08/04	14 15	156	144		133	0	130	21
70/09/01	13 30	177	156		136	0	141	30
70/10/22	14 30	187		113	138		160	
70/11/16	12 45	212		116	141		160	
70/12/07	15 30	214		128	156		170	
71/01/19	09 30	196	210	121	148	0	180	50
71/02/19	13 00	198		112	137		150	
71/03/18	10 00	226		116	141		170	
71/04/15	13 00	188		115	140		150	
71/05/19	12 00	120		92	112		100	
71/06/10	10 30	122		84	109		91	
71/07/14	12 00	118		84	102		97	
71/08/11	11 00	132	133	94	115		110	13
71/09/08	12 30	150	156	106	129		130	
71/10/15	11 00	192		116	141		160	
71/11/12	12 00	202		116	141		160	
71/12/17	10 30	224		142	173		180	
72/01/05	12 00	216		134	163		170	
72/02/08	16 00	220	212	135	163		180	45
72/03/13	12 00	178	176	115	140		140	25
72/03/20	13 30	152		99	121		120	
72/03/27	10 30	158	152	106	129		130	21

TABLE 37.3 CHEMICAL DATA KOOTENAI RIVER BELOW LIBBY DAM

DATE FROM TO	TIME OF DAY	00600 TOTAL N N MG/L	00605 ORG N N MG/L	00610 NH3-N TOTAL MG/L	00613 NO2-N DISS MG/L	00618 NO3-N DISS MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P	00671 PHOS-DIS ORTHO MG/L P	00680 T ORG C C MG/L
67/09/07	14 30								0.430	0.390	
67/10/11	08 00								0.720	0.530	
67/11/07	10 30								0.080	0.080	
67/12/15	15 00								0.580	0.490	
68/01/24	13 05								1.200	1.080	
68/03/07	17 30								0.820	0.820	
68/04/24	18 40								0.720	0.690	
68/05/21	21 45								0.330	0.320	
68/06/17	18 15								0.210	0.170	
68/07/23	15 30								0.150	0.140	
68/08/28	16 00								0.550	0.550	
68/10/01	18 15								0.160	0.110	
68/12/05	14 15									0.430	
69/02/04	15 30								0.210	0.200	
69/03/04	16 00								0.200	0.190	
69/04/03	13 15								0.020	0.010	
69/05/07	18 00								0.070	0.060	
69/06/05	11 15	0.85	0.660	0.100		0.09					
69/07/08	09 30	0.85	0.080	0.760	0.010	0.00			0.240	0.030	
69/08/04	18 45	0.73	0.360	0.360	0.010	0.00			0.490	0.230	
69/09/02	17 15	0.49	0.080	0.400	0.010	0.00			0.230	0.020	
69/10/15	10 00	0.24	0.160	0.030	0.000	0.05		0.190	0.090	0.030	
69/11/04	16 30	0.21	0.100	0.050	0.000	0.06		0.550	0.220	0.120	
69/12/02	14 30	0.35	0.110	0.060	0.000	0.18		0.270	0.250	0.160	
70/01/12	15 00	0.47	0.080	0.110	0.000	0.28		0.080	0.080	0.070	
70/02/04	14 30	0.39	0.080	0.060	0.000	0.25		0.080	0.040	0.040	
70/03/04	14 15	0.41	0.070	0.090	0.010	0.24		0.180	0.140	0.130	
70/04/06	14 00	0.29	0.120	0.020	0.020	0.13		0.130	0.100	0.010	
70/05/06	14 30	0.62	0.310	0.030	0.110	0.17		0.240	0.100	0.090	
70/06/04	18 00	0.51	0.180	0.080	0.010	0.24		0.430	0.040	0.040	
70/07/06	13 00	0.18	0.120	0.020	0.000	0.04		0.130	0.130	0.100	
70/08/04	14 15	0.10	0.040	0.030	0.030	0.00		0.180	0.180	0.150	
70/09/01	13 30	0.08	0.060	0.010	0.000	0.01		0.100	0.090	0.080	
70/10/22	14 30	0.42	0.180	0.060	0.020	0.16		0.210		0.160	3.0
70/11/16	12 45	0.49	0.150	0.070	0.020	0.25		0.270		0.250	16.0
70/12/07	15 30	0.65	0.110	0.200	0.020	0.32		0.350		0.370	2.0
71/01/19	09 30	0.09	0.000	0.000	0.000	0.09	0.1			0.000	4.0
71/02/19	13 00	0.12	0.000	0.010	0.010	0.10	0.1	0.230		0.100	0.0
71/03/18	10 00	0.53	0.070	0.360	0.000	0.10	0.1	0.260		0.160	5.0
71/04/15	13 00	0.57	0.240	0.230	0.000	0.10		0.100		0.050	7.0
71/05/19	12 00	0.32	0.180	0.040	0.000	0.10	0.1	0.250		0.140	18.0
71/06/10	10 30	0.37	0.230	0.060	0.000	0.08	0.1	0.200		0.040	6.0
71/07/14	12 00	0.25	0.180	0.070	0.000	0.00	0.0	0.050		0.010	5.0
71/08/11	11 00	0.37	0.090	0.250	0.000	0.03	0.03	0.080		0.010	0.0
71/09/08	12 30	0.27	0.160	0.080	0.000	0.03	0.03	0.110		0.030	3.0
71/10/15	11 00	0.24	0.150	0.000	0.000	0.09	0.1	0.160		0.010	1.0
71/11/12	12 00	0.57	0.230	0.150	0.000	0.19	0.2	0.040		0.080	1.0
71/12/17	10 30	0.47	0.120	0.130	0.000	0.22	0.2	0.270		0.200	
72/01/05	12 00	0.51	0.160	0.110	0.000	0.24	0.2	0.160		0.130	3.0
72/02/08	16 00	0.92	0.280	0.050	0.000	0.59	0.6	0.180		0.120	3.0
72/03/13	12 00	0.76	0.210	0.070	0.000	0.48	0.5	0.140		0.110	2.0
72/03/20	13 30	1.10	0.240	0.070	0.000	0.79	0.8	0.110		0.010	1.0
72/03/27	10 30	0.46	0.210	0.080	0.000	0.17	0.2	0.120		0.010	2.5

TABLE 37.4 CHEMICAL DATA

KOOTENAI RIVER BELOW LIBBY DAM

DATE FROM TO	TIME OF DAY	00915 CALCIUM CA,DISS MG/L	00925 MGNSIUM MG,DISS MG/L	00930 SODIUM NA,DISS MG/L	00935 PTSSIUM K,DISS MG/L	00940 CHLORIDE CL MG/L	00945 SULFATE SO4-TOT MG/L	00950 FLUORIDE F,DISS MG/L	00955 SILICA DISOLVED MG/L
67/06/29	09 15	32.0	6.6	1.40	0.50	1	17	0.50	4.3
67/07/26	16 30	37.0	8.7	1.60	1.60	1	38	0.70	5.2
67/09/07	14 30	53.0	11.0	2.80	0.70	2	68	1.30	5.8
67/12/15	15 00	81.0	15.0	3.80	2.00	3	133	2.00	7.4
68/03/07	17 30	71.0	12.0	3.50	0.80	2	114	0.90	7.8
68/05/27	15 30	33.0	7.1	1.50	0.60	2	26	0.40	6.3
68/08/28	16 00	49.0	10.0	2.40	0.80	2	64	1.20	5.1
68/12/05	14 15	42.0	12.0	3.00	0.80	2	36	0.90	6.3
69/02/04	15 30	46.0	13.0	3.40	0.80	3	44	0.90	7.5
69/03/04	16 00	46.0	13.0	3.50	0.80	2	44	1.10	7.2
69/04/03	13 15	40.0	11.0	3.30	1.00	2	38	0.80	8.3
69/05/07	18 00	34.0	8.8	2.50	0.60	1	19	0.30	7.3
69/06/05	11 15	30.0	6.3	1.00	0.60	1	12	0.20	2.8
69/07/08	09 30	36.0	8.4	2.10	0.50	2	17	0.30	4.5
69/08/04	18 45	35.0	11.0	2.60	0.90	2	27	0.20	4.8
69/09/02	17 15	38.0	12.0	3.30	2.60	2	28	0.20	5.2
69/10/15	10 00	39.0	14.0	3.60	0.80	2	34	0.70	5.2
69/11/04	16 30	41.0	13.0	4.50	1.00	3	38	0.50	6.8
69/12/02	14 30	47.0	14.0	4.10	2.20	5	41	0.70	6.7
70/01/12	15 00	48.0	16.0	5.90	0.80	4	47	0.60	7.2
70/02/04	14 30	48.0	14 0	5.40	1.00	5	46	0.80	6.7
70/03/04	14 15	50.0	14.0	5.40	1.20	5	51	1.10	7.7
70/04/06	14 00	45.0	14.0	6.00	1.00	3	48	0.90	6.0
70/05/06	14 30	33.0	8.7	2.90	1.20	2	25	0.60	5.9
70/06/04	18 00	23.0	6.0	1.90	0.50	1	13	0.20	3.0
70/07/06	13 00	32.0	8.8	2.40	0.60	2	20	0.20	4.5
70/08/04	14 15	36.0	9.7	2.40	0.50	2	26	0.50	0.8
70/09/01	13 30	38.0	11.0	3.00	0.60	2	31	0.60	2.6
70/10/22	14 30	43.0	12.0	4.30	0.80	5	41	0.90	5.1
70/11/16	12 45	43.0	12.0	6.90	0.80	4	43	0.60	5.0
70/12/07	15 30	46.0	13.0	5.70	1.10	5	46	1.10	7.5
71/01/19	09 30	49.0	14.0	5.20	0.70	15	42	0.90	6.6
71/02/19	13 00	42.0	12.0	4.10	0.90	3	35	1.10	7.0
71/03/18	10 00	47.0	13.0	5.90	1.00	5	44	1.50	5.5
71/04/15	13 00	40.0	12.0	3.90	1.00	2	34	1.10	7.1
71/05/19	12 00	29.0	7.9	1.80	0.60	2	15	0.30	6.5
71/06/10	10 30	26.0	6.4	0.80	0.50	1	11	0.20	5.0
71/07/14	12 00	27.0	7.2	1.50	0.40	1	25	0.20	4.4
71/08/11	11 00	31.0	8.7	2.30	0.80	4	21	0.50	3.4
71/09/08	12 30	36.0	10.0	3.20	0.60	3	28	0.70	4.9
71/10/15	11 00	41.0	13.0	4.20	0.40	4	35	0.90	5.5
71/11/12	12 00	44.0	13.0	4.40	0.90	5	33	0.90	5.7
71/12/17	10 30	49.0	14.0	5.10	2.80	5	42	1.00	7.0
72/01/05	12 00	45.0	14.0	4.40	0.90	5	41	1.00	7.0
72/02/08	16 00	48.0	15.0	5.30	0.70	6	43	1.10	7.3
72/03/13	12 00	38.0	11.0	4.60	0.90	5	33	0.90	8.9
72/03/20	13 30	34.0	9.5	3.30	1.00	2	25	0.60	8.4
72/03/27	10 30	35.0	9.5	3.10	0.80	3	26	0.50	9.0

TABLE 37.5 CHEMICAL DATA

KOOTENAI RIVER BELOW LIBBY DAM

DATE FROM TO	TIME OF DAY	01000 ARSENIC AS,DISS UG/L	01002 ARSENIC AS,TOT UG/L	01005 BARIUM BA,DISS UG/L	01010 BERYLIUM BE,DISS UG/L	01020 BORON B,DISS UG/L	01022 BORON B,TOT UG/L	01025 CADMIUM CD,DISS UG/L	01027 CADMIUM CD,TOT UG/L	01030 CHROMIUM CR,DISS UG/L	01032 CHROMIUM HEX-VAL UG/L	01034 CHROMIUM CR, TOT UG/L
67/06/29	09 15					0						
67/07/26	16 30					10						
67/09/07	14 30					10						
67/12/15	15 00					0						
68/03/07	17 30					100						
68/05/27	15 30					20						
68/08/28	16 00					0						
68/12/05	14 15					10						
69/02/04	15 30					40						
69/03/04	16 00					10						
69/04/03	13 15					10						
69/05/07	18 00					0						
69/06/05	11 15					0						
69/07/08	09 30					0						
69/08/04	18 45					20						
69/09/02	17 15					0						
69/10/15	10 00					5						
69/11/04	16 30					1						
69/12/02	14 30					41						
70/01/12	15 00					9						
70/02/04	14 30					23						
70/03/04	14 15					4						
70/04/06	14 00					6						
70/05/06	14 30					2						
70/06/04	18 00					4						
70/07/06	13 00					10						
70/08/04	14 15					10						
70/09/01	13 30					10						
70/10/22	14 30	10		0	0.00	0		0		0	0	
70/11/16	12 45	0		0	0.00	20		0		0	0	
70/12/07	15 30	20		0	0.00	10		0		0	0	
71/01/19	09 30	40		0	0.00	10		0		2	0	
71/02/19	13 00	10		220	5.00	0		0		0	0	
71/03/18	10 00	10		220	0.00	0		1		0	0	
71/04/15	13 00	0		100	0.00	20		0			1	
71/05/19	12 00	0		0	0.00	0		0	2	0	0	
71/06/10	10 30	3		0	0.00	20		0	2	0	0	
71/07/14	12 00	0		0	0.00	10		0	< 1	0	0	
71/08/11	11 00	0		600	0.00	0		0	< 1	0	0	
71/09/08	12 30	0		0	0.00	10		0	< 1	0	0	
71/10/15	11 00	0	7	400	0.00	10		1	< 1	0	0	
71/11/12	12 00	0		100	0.00	10		0	< 2	0	0	
71/12/17	10 30	7		0	0.00	20		0	< 1	0	0	
72/01/05	12 00	1		0	0.00	10		0	< 1	2	0	
72/02/08	16 00	9		0	0.00	10		0	1	0	0	
72/03/13	12 00	8		0	0.00	8		1	1	0	0	
72/03/20	13 30	1		0	0.00	0		0	1	0	0	
72/03/27	10 30	6		0	0.00	20		0	1	0	0	

TABLE 37.6 CHEMICAL DATA KOOTENAI RIVER BELOW LIBBY DAM

DATE FROM TO	TIME OF DAY	01035 COBALT CO,DISS UG/L	01037 COBALT CO,TOTAL UG/L	01040 COPPER CU,DISS UG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01046 IRON FE,DISS UG/L	01049 LEAD PB,DISS UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01056 MANGNESE MN,DISS UG/L
67/12/15	15 00					20					
68/03/07	17 30					240					
68/05/27	15 30					30					
68/08/28	16 00					0					
68/12/05	14 15						100				
69/02/04	15 30						120				
69/03/04	16 00						70				
69/04/03	13 15						80				
69/05/07	18 00						60				
69/06/05	11 15						40				
69/07/08	09 30						70			11.0	
69/08/04	18 45						30				
69/09/02	17 15						80				
69/10/15	10 00						16				25.0
69/11/04	16 30						115				48.0
69/12/02	14 30						101				34.0
70/01/12	15 00						30				14.0
70/02/04	14 30						33				22.0
70/03/04	14 15						46				58.0
70/04/06	14 00						15				38.0
70/05/06	14 30						133				29.0
70/06/04	18 00						0				11.0
70/07/06	13 00						47				17.0
70/08/04	14 15						59				11.0
70/09/01	13 30						37				22.0
70/10/22	14 30	0		17			70	0			28.0
70/11/16	12 45	0		0			20	0			20.0
70/12/07	15 30	0		0			30	0			57.0
71/01/19	09 30	0		0			110	0			0.0
71/02/19	13 00	2		0			160	5			250.0
71/03/18	10 00	6		1			160	6			43.0
71/04/15	13 00	1		4			40	0			20.0
71/05/19	12 00	0	< 1	0	< 10	810	80	1	9	30.0	0.0
71/06/10	10 30	0	4	1	< 10	2600	60	4	29	130.0	50.0
71/07/14	12 00	1	< 1	1	< 10	420	20	0	< 1	20.0	49.0
71/08/11	11 00	0	< 1	1	< 10	30	20	2	3	< 10.0	20.0
71/09/08	12 30	0	< 1	1	< 10	220	10	0	3	10.0	20.0
71/10/15	11 00	2	2	1	1	80	50	2	7		20.0
71/11/12	12 00	0	< 1	0	4	70	10	0	3	30.0	30.0
71/12/17	10 30	1	< 1	0	3	80	20	1	1	< 10.0	
72/01/05	12 00	2	2	0	< 1	80	10	0	< 1	< 10.0	8.0
72/02/08	16 00	9	9	1	2	40	20	2	2	10.0	10.0
72/03/13	12 00	0	0	2	50	260	40	1	12	40.0	30.0
72/03/20	13 30	0	1	1	9	350	20	0	12	60.0	10.0
72/03/27	10 30	0	0	7	19	620	20	2	14	60.0	40.0

TABLE 37.7 CHEMICAL DATA — KOOTENAI RIVER BELOW LIBBY DAM

DATE FROM TO	TIME OF DAY	01060 MOLY MO,DISS UG/L	01065 NICKEL NI,DISS UG/L	01075 SILVER AG,DISS UG/L	01080 STRONTUM SR,DISS UG/L	01082 STRONTUM SR,TOT UG/L	01085 VANADIUM V,DISS UG/L	01090 ZINC ZN,DISS UG/L	01092 ZINC ZN,TOT UG/L
70/10/22	14 30	3	0	1.0	220		0.1	30	
70/11/16	12 45	0	2	1.0	220		0.0	30	
70/12/07	15 30	2	0	1.0	170		0.5	40	
71/01/19	09 30	0	3	0.0	180		0.0	60	
71/02/19	13 00	0	3	1.0	210		0.7	30	
71/03/18	10 00	0	2	0.0	290		0.7	28	
71/04/15	13 00	3	0	1.0	280		0.0	30	
71/05/19	12 00	1	0	0.0	80		0.6	40	30
71/06/10	10 30	1	0	0.0	160		0.0	0	<10
71/07/14	12 00	0	2	0.0	40		0.0	7	10
71/08/11	11 00	0	1	0.0	90		0.7	0	<10
71/09/08	12 30	3	4	0.0	210		0.0	30	10
71/10/15	11 00	8	4	0.0	210		0.0	20	30
71/11/12	12 00	0	0	0.0	190		0.0	40	40
71/12/17	10 30	1	0	0.0	360		0.8	10	20
72/01/05	12 00	0	1	0.0	220		0.1	20	20
72/02/08	16 00	5	2	1.0	290		0.0	20	20
72/03/13	12 00	2	4	0.0	180		0.2	20	50
72/03/20	13 30	0	5	0.0	160		0.6	20	40
72/03/27	10 30	0	4	0.0	120		1.0	20	60

TABLE 37.8 CHEMICAL DATA — KOOTENAI RIVER BELOW LIBBY DAM

DATE FROM TO	TIME OF DAY	01106 ALUMINUM AL,DISS UG/L	01130 LITHIUM LI,DISS UG/L	01145 SELENIUM SE DISS UG/L	31501 TOT COLI MFIMENDO /100 ML	31503 TOT COLI MFDLENDO /100 ML	71890 MERCURY HG,DISS UG/L	71900 MERCURY HG,TOTAL UG/L	31503 TOT COLI MFDLENDO /100 ML	31616 FEC COLI MFM-FCBR /100 ML	38260 MBAS MG/L
70/10/22	14 30	100	10				0.0				0.02
70/11/16	12 45	100	0				0.2				0.00
70/12/07	15 30	100	10				0.4				0.00
71/01/19	09 30	200	0				0.0				0.00
71/02/19	13 00	300	0				0.1				0.00
71/03/18	10 00	100	0				0.1				0.00
71/04/15	13 00	300	4				0.2				0.00
71/05/19	12 00	400	2				0.1	0.5			0.00
71/06/10	10 30	300	0				0.0				0.00
71/07/14	12 00	200	22				0.1	< 0.5			0.00
71/08/11	11 00	100	11				0.0	< 0.5			0.00
71/09/08	12 30	200	5				0.1	< 0.5			0.00
71/10/15	11 00	200	10				0.0				0.00
71/11/12	12 00	0	0				0.1	< 0.5			0.00
71/12/17	10 30	0	0				0.3	< 0.5			0.00
72/01/05	12 00	0	10				0.3	< 0.5			0.00
72/02/08	16 00	100	0				0.4	< 0.5			0.00
72/03/13	12 00	100	17				1.0	1.2			0.00
72/03/20	13 30	100	0				0.1	0.1			0.00
72/03/27	10 30	0	0				0.1	0.1			0.00

TABLE 38.1 CHEMICAL DATA

KOOTENAI RIVER AT LIBBY, MONT.

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00060 STREAM FLOW CFS	00070 TURB JKSN JTU	00080 COLOR PT-CO UNITS	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00310 BOD 5 DAY MG/L	00400 PH SU	00405 CO2 MG/L
68/03/13	13 15		6.5				450	12.5	109.0		8.30	
68/04/03	12 35		6.0		2.0	10	390	12.7	110.0		8.50	
68/05/08	12 15		10.5		6.0	10	280	10.8	103.0		7.70	
68/06/04	12 25		13.0		66.0	20	150	10.3	104.0		7.60	
68/07/10	06 45		16.0		3.0	6	165	8.9	95.0		8.00	
68/08/06	16 00		18.6		1.0	2	245	8.7	99.0		8.30	
68/08/20	11 15		15.0		1.0	<5	290	9.8	103.0		8.00	
69/09/24	18 15		11.2		3.0	5	250	11.0	107.0		8.50	
68/11/12	18 00		4.0		<1.0	5	250	11.9	97.0		7.60	
68/12/17	07 15		1.5		4.0	5	300	13.1	100.0		7.80	
69/01/21	12 00		0.1		6.0	5	350	11.7	86.0		7.60	
69/02/19	18 30		0.1		10.0	10	350	11.8	87.0		8.10	
69/03/18	17 45		1.5		16.0	7	320	12.1	93.0		7.50	
69/04/22	10 00		7.5		12.0	15	230	10.5	93.0		8.00	
69/05/14	09 00		9.5		88.0	20	170	10.5	99.0		7.40	
69/06/09	11 00		10.8		50.0	10	180	10.0	98.0		7.90	
69/07/09	08 10		13.0	32700	22.0	7	240	9.4	97.0	1.9	7.20	
	14 00		15.0		12.0	5	225	9.2	97.0		8.00	
69/08/12	15 40		17.0	9450	4.0	2	255	8.6	96.0	0.9	8.20	
69/09/16	17 00		13.5	5980	8.0	1	300	10.4	108.0	1.3	8.80	
69/10/15	08 30		5.0	5800	7.0	2	280	11.1	94.0	0.9	8.30	
69/11/11	13 30		5.0	4600	4.0	2	300	11.8	100.0	0.8	8.10	
69/12/16	15 45		0.5	3720	5.0	3	320	12.9	97.0	1.1	7.40	
70/01/13	16 00		0.0	3020	10.0	3	350	12.3	91.0	0.7	7.70	
70/02/10	09 15		0.0	2860	7.0	6	305	12.2	90.0	1.0	8.00	
70/03/17	06 45		3.0	3240	20.0	6	330	12.5	101.0	0.9	8.30	
70/04/14	15 30		7.0	4660	25.0	8	300	11.8	105.0	0.8	8.50	
70/05/12	14 15		8.0	18200	20.0	16	205	10.0	91.0	1.0	7.70	
70/06/09	06 40		12.0	50600	95.0	15	185	11.8	119.0	0.3	7.90	
70/07/22	15 00		19.0	9380	4.0		260	8.4	98.0	0.9	8.40	
70/08/19	09 00		16.5	8840	4.0		300	8.4	93.0	1.0	8.30	
70/09/15	13 30		9.5	4800			305	11.5	109.0	3.0	8.10	
70/10/13	12 00		7.5	4960	5.0	2	300	11.3	102.0	1.1	7.70	
70/11/16	15 00		3.5	3610			340	12.5	102.0	1.1	7.90	
70/12/09	11 45		0.0	4300			170	13.3	99.0	0.8	7.30	
71/01/20	13 30		0.0	4500		5	320	11.7	87.0	1.4	6.80	
71/02/16	13 15		2.5	6370			275	12.5	99.0	4.8	7.50	
71/03/16	13 00		4.0	3500			340	12.9	107.0	0.7	8.40	
71/04/13	12 00		6.0	7700	3.0	5	290	11.6	101.0	1.9	8.10	
71/05/18	11 45		7.5	36300			215	12.6	114.0	0.7	8.10	
71/06/08	12 00		9.0	62500			195	12.0	112.0	0.5	7.80	
71/07/28	11 00		17.0	20800	1.0	7	225	9.8	110.0	1.1	8.00	
71/08/16	10 30		17.0	11700	3.0	6	225	10.0	112.0	0.7	8.20	
71/09/15	09 30		11.5	7120	1.0	5	300	11.2	111.0	1.7	8.30	
71/10/12	10 15		9.0	5200	60.0	5	320	11.6	109.0	2.0	8.10	
71/11/09	10 00		0.5	3800	2.0	5	325	14.5	109.0	1.7	7.60	
71/12/14	10 30		0.0	2600	2.0	5	280	14.0	104.0	1.3	7.40	
72/01/06	10 30		0.0	3040	1.0	0	360	14.0	104.0	1.3	8.10	
72/02/09	09 00		0.0	3080	2.0	3	345	13.6	101.0	1.2	7.80	
72/03/16	10 00		4.5	10100	30.0	20	235	13.0	109.0	1.5	8.10	

KOOTENAI RIVER AT LIBBY, MONT.

TABLE 38.2 CHEMICAL DATA

DATE FROM TO	TIME OF DAY	70300 RESIDUE DISS-180 C MG/L	70301 DISS SOL SUM MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L	00445 CO3 ION CO3 MG/L	00900 TOT HARD CACO3 MG/L	00902 NC HARD CACO3 MG/L
68/03/13	13 15			104				
68/04/03	12 35			99			174	
68/05/08	12 15			86			144	
68/06/04	12 25			64			114	
68/07/10	06 45			71			140	
68/08/06	16 00			95			243	
68/08/20	11 15			96			552	
68/09/24	18 15			90			131	
68/11/12	18 00			87			115	
68/12/17	07 15			105			147	
69/01/21	12 00			114			152	
69/02/19	18 30			87			121	
69/03/18	17 45			110			142	
69/04/22	10 00			77			111	
69/05/14	09 00			86			91	
68/06/09	11 00			84			91	
69/07/09	08 10	134		110			119	
	14 00			194			114	
69/08/12	15 40	168		126			141	
69/09/16	17 00	171		186			162	
69/10/15	08 30	179		125			154	
69/11/11	13 30	179		121			156	
69/12/16	15 45	210		135			180	
70/01/13	16 00	259		148			189	
70/02/10	09 15	205		133			179	
70/03/17	06 45	213		130			172	
70/04/14	15 30	189		121			158	
70/05/12	14 15	124		92			99	
70/06/09	06 40	93		77			86	
70/07/22	15 00	148		110			126	
70/08/19	09 00			117				
70/09/15	13 30			124				
70/10/13	12 00	183		116			150	
70/11/16	15 00			122				
70/12/09	11 45			122				
70/01/20	13 30	180		120			160	
71/02/16	13 15			98				
71/03/16	13 00			120				
71/04/13	12 00	156		100			140	
71/05/18	11 45			88				
71/06/08	12 00			93				
71/07/28	11 00			84			100	
71/08/16	10 30			97				
71/09/15	09 30			117				
71/10/12	10 15			115			150	
71/11/09	10 00			119				
71/12/14	10 30			140				
72/01/06	10 30			137			160	
72/02/09	09 00			129				
72/03/16	10 00			90				

TABLE 38.3 CHEMICAL DATA

KOOTENAI RIVER AT LIBBY, MONT.

DATE FROM TO	TIME OF DAY	DEPTH FEET	00600 TOTAL N N MG/L	00605 ORG N N MG/L	00610 NH3-N TOTAL MG/L	00613 NO2-N DISS MG/L	00618 NO3-N DISS MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P	00671 PHOS-DIS ORTHO MG/L P	00680 T ORG C C MG/L
68/03/13	13 15					< 0.010	0.03		0.930		0.840	
68/04/03	12 35		0.35	0.200	0.100	0.004	0.05		0.410		0.350	
68/05/08	12 15		0.41	0.200	< 0.100	< 0.010	0.11		0.240		0.170	
68/06/04	12 25		0.80	0.210	0.490	0.009	0.09		0.130		0.087	9.0
68/07/10	06 45		0.36	0.250	< 0.050	< 0.005	0.06		0.190		0.110	2.0
68/08/06	16 00		0.20	0.190	< 0.010	< 0.005	< 0.005		0.069		0.050	2.0
68/08/20	11 15		0.21	0.190	0.010	< 0.005	0.01		0.780		0.770	1.0
68/09/24	18 15		0.26	0.190	< 0.005	0.005	0.06		0.200		0.170	1.0
68/11/12	18 00		1.00	0.890	< 0.010	< 0.010	0.10		0.120		0.069	1.0
68/12/17	07 15		0.60	0.390	0.010	< 0.020	0.20		0.190		0.160	1.0
69/01/21	12 00		0.50	0.270	0.030	< 0.020	0.20		0.170		0.170	< 1.0
69/02/19	18 30			0.060	0.140	0.015			0.190		0.180	4.0
69/03/18	17 45		0.21	0.090	< 0.010	< 0.005	0.11		0.140		0.096	< 1.0
69/04/22	10 00		0.43	0.230	0.070	0.005	0.13		0.140		0.027	2.0
69/05/14	09 00		0.69	0.270	0.230	0.030	0.16		0.380		0.026	6.0
69/06/09	11 00				0.030	0.010	0.08		0.180		0.028	2.0
69/07/09	08 10		0.30	0.100	0.160	0.000	0.04		0.270	0.060		
	14 00				< 0.050				0.100		0.039	2.0
69/08/12	15 40		0.53	0.520	0.000	0.000	0.01		0.190	0.130		15.0
69/09/16	17 00		0.07	0.000	0.030	0.000	0.04		0.100	0.060		5.5
69/10/15	08 30		0.08	0.040	0.000	0.000	0.04		0.220	0.050		5.0
69/11/11	13 30		1.33	1.200	0.030	0.000	0.10		0.170	0.110		
69/12/16	15 45		0.32	0.100	0.020	0.010	0.19		0.210	0.200		1.0
70/01/13	16 00		0.54	0.270	0.060	0.010	0.20		0.100	0.080		2.0
70/02/10	09 15		0.35	0.060	0.060	0.030	0.20		0.180	0.100		2.0
70/03/17	06 45		0.37	0.110	0.040	0.020	0.20		0.360	0.040		0.0
70/04/14	15 30		0.35	0.220	0.000	0.030	0.10		0.170	0.130		4.0
70/05/12	14 15		0.40	0.220	0.010	0.060	0.11		0.150	0.120		3.0
70/06/09	06 40		0.37	0.220	0.010	0.040	0.10		0.310	0.020		3.0
70/07/22	15 00			0.270	0.020		0.01		0.250	0.230	0.210	3.0
70/08/19	09 00			0.060	0.020		0.00		0.240	0.230	0.210	3.0
70/09/15	13 30		0.38	0.300	0.050	0.000	0.03		0.260	0.100	0.080	2.0
70/10/13	12 00		0.28	0.200	0.000	0.010	0.07		0.130	0.140	0.140	58.0
70/11/16	15 00		0.50	0.130	0.090	0.010	0.27		0.280	0.240	0.240	5.0
70/12/09	11 45		0.95	0.560	0.130	0.010	0.25		0.310	0.210	0.200	36.0
71/01/20	13 30			0.000		0.030	0.02	0.0		0.210	0.200	4.0
71/02/16	13 15		0.38	0.060	0.020	0.000	0.30	0.3	0.160	0.130	0.120	2.0
71/03/16	13 00		0.33	0.020	0.310	0.000	0.00	0.0	0.350	0.200	0.200	7.0
71/04/13	12 00		0.23	0.080	0.050	0.000	0.10	0.1	0.100	0.050	0.050	7.0
71/05/18	11 45		0.35	0.180	0.070	0.000	0.10	0.1	0.199	0.060	0.070	5.0
71/06/08	12 00		0.37	0.180	0.090	0.010	0.09	0.1	0.320	0.050	0.060	0.0
71/07/28	11 00				0.100	0.000	0.02	0.02	0.050	0.030	0.010	6.0
71/10/12	10 15		0.22	0.090	0.080	0.000	0.05	0.05	0.160	0.100	0.040	5.0
72/01/06	10 30		0.33	0.170	0.110	0.000	0.05	0.05	0.170	0.140	0.140	1.0

TABLE 38.4 CHEMICAL DATA

KOOTENAI RIVER AT LIBBY, MONT.

DATE FROM TO	TIME OF DAY	DEPTH FEET	00915 CALCIUM CA, DISS MG/L	00925 MGNSIUM MG,DISS MG/L	00930 SODIUM NA,DISS MG/L	00935 PTSSIUM K,DISS MG/L	00940 CHLORIDE CL MG/L	00945 SULFATE SO4-TOT MG/L	00950 FLUORIDE F,DISS MG/L	00955 SILICA DISOLVED MG/L
68/03/13	13 15					1.00				6.9
68/04/03	12 35				2.50	0.90	2	30		7.3
68/05/08	12 15				2.50	0.90	1	40		6.4
68/06/04	12 25				1.20	0.70	1	28		4.6
68/07/10	06 45				1.00	0.60	1	28		4.6
68/08/06	16 00				2.20	1.00	2	27		2.9
68/08/20	11 15				2.10	0.60	2	48		5.5
68/09/24	18 15						2	32		
68/11/12	18 00				2.20	0.70	2	28		6.0
68/12/17	07 15				2.70	0.67	1	33		5.7
69/01/21	12 00				3.20	0.84	2	30		6.4
69/02/19	18 30				3.30	0.73	2	42		6.9
69/03/18	17 45				3.20	1.20	2	41		7.0
69/04/22	10 00				2.30	0.85	1	22		9.0
69/05/14	09 00				1.20	0.94	<1	30		6.0
69/06/09	11 00						1	<10		4.5
69/07/09	08 10					0.50	1			
	14 00				1.70	0.60	1	21		
69/08/12	15 40						1			
69/09/16	17 00					0.80	2		0.70	
69/10/15	08 30						2			
69/11/11	13 30						3			
69/12/16	15 45						6			
70/01/13	16 00						4			
70/02/10	09 15						1			
70/03/17	06 45					1.00	3			
70/04/14	15 30						2			
70/05/12	14 15						2			
70/06/09	06 40						1			
70/07/22	15 00						3	26	0.30	
70/08/19	09 00							28		
70/10/13	12 00						4	35	0.70	
71/01/20	13 30		45.0	12.0			4		0.90	6.5
71/02/16	13 15						3		1.00	8.2
71/04/13	12 00			11.0			2	31	0.90	
71/07/28	11 00		29.0	7.4		0.30			0.20	
71/08/16	10 30								0.30	
71/09/15	09 30								0.50	
71/10/12	10 15		41.0	12.0		0.90			0.60	
71/11/09	10 00								0.90	
71/12/14	10 30								0.80	
72/01/06	10 30		43.0	14.0		0.90			1.00	
72/02/09	09 00								1.00	
72/03/16	10 00								0.70	

TABLE 38.5 CHEMICAL DATA

KOOTENAI RIVER AT LIBBY, MONT.

DATE FROM TO	TIME OF DAY	01000 ARSENIC AS,DISS UG/L	01002 ARSENIC AS,TOT UG/L	01005 BARIUM BA,DISS UG/L	01010 BERYLIUM BE,DISS UG/L	01020 BORON B,DISS UG/L	01022 BORON B,TOT UG/L	01025 CADMIUM CD,DISS UG/L	01027 CADMIUM CD,TOT UG/L	01030 CHROMIUM CR,DISS UG/L	01032 CHROMIUM HEX-VAL UG/L	01034 CHROMIUM CR, TOT UG/L
69/07/09	08 10					10						
69/08/12	15 40					3						
69/09/16	17 00	4		0		8		0		0		0
70/03/17	06 45					155						
71/07/28	11 00	0	0					0	< 1	0		0
71/10/12	10 15	1	10					0	1	0		4
72/01/06	10 30	8	8					0	< 1	2		3

TABLE 38.6 CHEMICAL DATA

KOOTENAI RIVER AT LIBBY, MONT.

DATE FROM TO	TIME OF DAY	01035 COBALT CO,DISS UG/L	01037 COBALT CO,TOTAL UG/L	01040 COPPER CU,DISS UG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01046 IRON FE,DISS UG/L	01049 LEAD PB,DISS UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01056 MANGNESE MN,DISS UG/L
69/02/19	18 30			5		1450		15			
69/09/16	17 00	1		3			36	0			
71/01/20	13 30						70				
71/07/28	11 00			1	< 10	140	20	0	5		
71/08/16	10 30						20				
71/09/15	09 30						20				
71/10/12	10 15			0	1	170	20	1	4		
71/11/09	10 00						10				
71/12/14	10 30						20				
72/01/06	10 30			1	1	40	10	0	4		
72/02/09	09 00						10				
72/03/16	10 00						50				

TABLE 38.7 CHEMICAL DATA

KOOTENAI RIVER AT LIBBY, MONT.

DATE FROM TO	TIME OF DAY	01060 MOLY MO,DISS UG/L	01065 NICKEL NI,DISS UG/L	01075 SILVER AG,DISS UG/L	01080 STRONTUM SR,DISS UG/L	01082 STRONTUM SR,TOT UG/L	01085 VANADIUM V,DISS UG/L	01090 ZINC ZN,DISS UG/L	01092 ZINC ZN,TOT UG/L
69/02/19	18 30							39	
69/09/16	17 00	0	0	0.0	260		1	8	
71/07/28	11 00							20	30
71/08/16	10 30							10	
71/09/15	09 30							10	
71/10/12	10 15							0	10
71/11/09	10 00							40	
71/12/14	10 30							20	
72/01/06	10 30							20	20
72/02/09	09 00							20	
72/03/16	10 00							10	

TABLE 38.8 CHEMICAL DATA

KOOTENAI R'VER AT LIBBY, MONT.

DATE FROM TO	TIME OF DAY	01106 ALUMINUM AL,DISS UG/L	01130 LITHIUM LI,DISS UG/L	01145 SELENIUM SE,DISS UG/L	31501 TOT COLI MFIMENDO /100 ML	31503 TOT COLI MFDLENDO /100 ML	71890 MERCURY HG,DISS UG/L	71900 MERCURY HG,TOTAL UG/L	31503 TOT COLI MFDLENDO /100 ML	31616 FEC COLI MFM-FCBR /100 ML	38260 MBAS MG/L
68/03/13	13 15					10			10		
68/04/03	12 35					240			240		
68/05/08	12 15					980			980		
68/06/04	12 25					3600			3600		
68/07/10	06 45					420			420		
68/08/06	16 00					95			95		
68/08/20	11 15					40			40		
68/09/24	18 15					< 100			< 100		
68/11/12	18 00					< 100			< 100		
68/12/17	07 15					80			80		
69/01/21	12 00					100			100		
69/03/18	17 45					40			40		
69/04/22	10 00					1950			1950		
69/05/14	09 00					3000			3000		
69/06/09	11 00					400			400		
69/07/09	14 00					400			400		
69/09/16	17 00			2	8					2	
69/10/15	08 30				2					1	
69/11/11	13 30				12					3	
69/12/16	15 45				78					11	
70/01/13	16 00				21					6	
70/02/10	09 15				17					2	
70/03/17	06 45				64						
70/04/14	15 30				38					2	
70/05/12	14 15				290					10	
70/06/09	06 40				830					25	
70/07/22	15 00									1	
70/08/19	09 00				20					4	
70/09/15	13 30				16					0	
70/10/13	12 00				12					4	
70/11/16	15 00				12					1	
70/12/09	11 45				38					1	
70/01/20	13 30				120					86	
71/02/16	13 15				120					20	
71/03/16	13 00				1					0	
71/04/13	12 00				22					4	
71/05/18	11 45				48					80	
71/06/08	12 00				320					120	
71/07/28	11 00			0	22		0.0	0.0		4	
71/08/16	10 30				25		0.8			0	
71/09/15	09 30				68		0.9			6	
71/10/12	10 15			2	24		0.1	0.4		4	
71/11/09	10 00				320		0.0			69	
71/12/14	10 30				43		0.2			1	
72/01/06	10 30			1			0.2	0.2		2	
72/02/09	09 00				700		0.3			73	
72/03/16	10 00	100			190		0.1			17	

TABLE 39.1 CHEMICAL DATA

KOOTENAI RIVER AT LEONIA, IDAHO

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00060 STREAM FLOW CFS	00070 TURB JKSN JTU	00080 COLOR PT-CO UNITS	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00310 BOD 5 DAY MG/L	00400 PH SU	00405 CO2 MG/L
68/03/13	11 00		5.8				325	12.3	104.0		8.30	
68/04/03	10 45		6.0		2.0	10	300	12.9	111.0		8.30	
68/04/17	13 30		7.0		2.0	10	345	13.1	115.0		8.20	
68/05/08	13 30		10.8		6.0	10	230	11.5	110.0		8.00	
68/06/04	11 05		13.0		89.0	20	200	11.5	115.0		7.90	
68/07/10	08 10		17.0		8.0	7	190	9.6	105.0		8.00	
68/08/06	14 00		18.3		1.0	2	210	8.9	100.0		8.20	
68/08/20	09 45		15.5		1.0	5	280				8.00	
68/11/12	13 15		4.0		2.0	10	235	12.7	103.0		7.80	
69/02/12	09 30		1.0		5.0	5	258	13.9	104.0		7.80	
69/03/18	18 00		2.0		5.0	3	315	13.8	106.0		8.20	
69/05/27	22 00		9.8		60.0	25	190	11.4	107.0		7.80	
69/08/19	20 00		16.9		1.0	5	270	10.1	111.0		8.00	
69/09/17	13 30		13.7				300	11.0	112.0		8.20	
69/10/20	17 00		5.0	5790	1.0	5	283	13.3	110.0	0.8	8.70	
69/11/18	12 55		2.5	4990	3.0	5	284	14.1	110.0	2.6	8.60	
69/12/16	14 20		0.5	3670	4.0	5	289	13.6	100.0	1.9	8.40	
70/01/28	10 25		0.0	3690	5.0	5	292	13.5	100.0	1.6	8.30	
70/02/25	14 05		2.0	3510	2.0	5	285	12.9	101.0	1.9	8.10	
70/03/24	14 30		7.5	4380	1.0	5	281	12.0	107.0	1.0	8.80	
70/04/27	13 05		7.0	6490	2.0	5	235	11.8	103.0	3.1	8.70	
70/05/18	13 40		10.5	38000	15.0	20	144	11.4	109.0	1.8	8.00	
70/06/16	09 20		10.8	34400	3.0	5	171	11.6	111.0	2.7	8.30	
70/07/14	12 45		16.9	14900	1.0	5	225	10.1	112.0	0.5	8.60	
70/08/17	16 00		19.0	6830	0.0		264	10.4	118.0	0.5	8.40	
70/09/22	09 15		10.1	6760	0.0	5	298	11.4	107.0	1.2	8.40	
70/10/20	13 20		7.0	4830	1.0	0	283	12.5	110.0	0.6	7.80	
70/11/17	09 10		4.5	4140			298	14.4	118.0	3.9	7.50	
70/12/15	08 00		1.5	3710			269	14.8	113.0	4.9	7.10	
71/01/20	07 15		0.0	5260			219	14.9	107.0	2.2	7.10	
71/02/24	09 30		2.0	6410			229	14.0	108.0	4.9	7.60	
71/03/24	09 15		3.5	4090			281	13.0	104.0	3.7	8.10	
71/04/20	09 00		7.0	12100	3.0	5	209	12.2	107.0	2.3	8.00	
71/05/25	13 20		10.5	48200			175	12.2	112.0	1.5	7.60	
71/06/22	08 35		13.0	42000			189	12.0	121.0	2.7	6.90	
71/07/27	08 35		16.5	25700	5.0	6	192	10.5	114.0	1.3	7.60	
71/08/18	13 45		18.0	10500	1.0	7	254	10.2	115.0	2.4	8.00	
71/09/22	09 05		10.0	6820	0.0	5	279	11.0	104.0	1.5	7.40	
71/10/19	09 45		6.1	5400	2.0	5	290	12.2	104.0	1.7	8.20	1.4
71/11/16	12 50		4.0	5500	5.0	5	292	13.2	107.0	1.2	7.70	4.4
71/12/07	13 10		0.0	3910	2.0	5	308	14.1	103.0	0.6	7.50	
72/01/10	10 00		0.0	2790	1.0	5	308	14.1	104.0	0.9	7.80	
72/02/03	14 30		0.1	3370	1.0	5	314	14.5	106.0	2.5	6.70	
72/03/02	08 35		0.8	10200	20.0	10	156	13.9	104.0	1.7	6.40	

TABLE 39.2 CHEMICAL DATA

KOOTENAI RIVER AT LEONIA, IDAHO

DATE FROM TO	TIME OF DAY	70300 RESIDUE DISS-180 C MG/L	70301 DISS SOL SUM MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L	00445 CO3 ION CO3 MG/L	00900 TOT HARD CACO3 MG/L	00902 NC HARD CACO3 MG/L
68/03/13	11 00			82	100			
68/04/03	10 45			82	100		131	
68/04/17	13 30			90	110		148	
68/05/08	13 30			72	88		117	
68/06/04	11 05			87	106		133	
68/07/10	08 10			77	94		163	
68/08/06	14 00			94	115		237	
68/08/20	09 45			96	117		279	
68/11/12	13 15			87	93		108	
69/02/12	09 30			113	138		132	
69/03/18	18 00			101	123		127	
69/05/27	22 00			83	101		94	
68/08/19	20 00			109	133		134	
69/09/17	13 30			117	143			
69/10/20	17 00	176		121	133	7	148	27
69/11/18	12 55	177		122	138	6	149	39
69/12/16	14 20	180		122	133	8	152	30
70/01/28	10 25	169		117	143	0	149	32
70/02/25	14 05	164		114	139	0	141	27
70/03/24	14 30	154		108	116	8	144	36
70/04/27	13 05	128		98	115	2	120	22
70/05/18	13 40	80		61	74	0	68	7
70/06/16	09 20	89		75	92	0	96	21
70/07/14	12 45	116		94	110	2	114	20
70/08/17	16 00	164		109	129	2		
70/09/22	09 15	177		118	132	6	145	27
70/10/20	13 20	173		117	142	0	150	34
70/11/17	09 10	179		118	144	0		
70/12/15	08 00	176		108	132	0		
71/01/20	07 15	156		79	96	0	110	31
71/02/24	09 30	120		89	108	0		
71/03/24	09 15	162		104	127	0		
71/04/20	09 00	104		84	102	0	98	0
71/05/25	13 20			77	94	0		
71/06/22	08 35	124		81	99	0		
71/07/27	08 35	106		80	98	0	91	11
71/08/18	13 45			86	104	0	115	0
71/09/22	09 05			112	137	0	140	0
71/10/19	09 45			113	138	0	140	2
71/11/16	12 50			114	139	0	140	1
71/12/07	13 10			120	146	0	152	32
72/01/10	10 00			120	146	0	150	30
72/02/03	14 30			124	151	0	160	36
72/03/02	08 35			64	78	0	74	10

TABLE 39.3 CHEMICAL DATA

KOOTENAI RIVER AT LEONIA IDAHO

DATE FROM TO	TIME OF DAY	DEPTH FEET	00600 TOTAL N N MG/L	00605 ORG N N MG/L	00610 NH3-N TOTAL MG/L	00613 NO2-N DISS MG/L	00618 NO3-N DISS MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P	00671 PHOS-DIS ORTHO MG/L P	00680 T ORG C C MG/L
68/03/13	11 00					<0.010	0.03		0.280		0.290	
68/04/03	10 45		0.33	0.200	0.100	0.003	0.03		0.340		0.320	
68/04/17	13 30		0.20	0.100	<0.100	<0.001	0.001		0.310		0.270	
68/05/08	13 30		0.41	0.200	<0.100	<0.010	0.10		0.190		0.130	
68/06/04	11 05		1.32	0.260	0.540	0.010	0.10		0.150		0.081	7.0
68/07/10	08 10		0.26	0.150	<0.050	<0.005	0.06		0.260		0.150	1.0
68/08/06	14 00		0.11	0.090	<0.010	0.005	<0.005		0.042		0.023	12.0
68/08/20	09 45		0.12	0.090	<0.010	0.005	0.01		0.460		0.460	<1.0
68/11/12	13 15		0.36	0.290	<0.010	<0.010	<0.05		0.130		0.085	1.0
69/02/12	09 30		0.42	0.170	0.030	<0.010	0.21		0.150		0.150	1.0
69/03/18	18 00		0.22	0.090	<0.010	<0.005	0.11		0.100		0.051	1.0
69/05/27	22 00		0.45	0.260	0.040	0.050	0.10		0.280		0.021	
69/08/19	20 00		0.23	0.180	<0.020	0.010	0.02		0.048		0.042	
69/09/17	13 30		0.45	0.380	0.020	0.001	0.05		0.081		0.062	11.0
69/10/20	17 00		0.04	0.020	0.020	0.000	0.00		0.030	0.03		8.0
69/11/18	12 55		0.10	0.060	0.040	0.000	0.00		0.060	0.05		6.5
69/12/16	14 20		0.11	0.010	0.000	0.010	0.09		0.010	0.01		0.5
70/01/28	10 25		0.19	0.060	0.020	0.000	0.11		0.040	0.03		6.0
70/02/25	14 05		0.08	0.010	0.000	0.000	0.07		0.050	0.05		0.0
70/03/24	14 30		0.09	0.040	0.000	0.000	0.05		0.010	0.00		1.0
70/04/27	13 05		0.06	0.020	0.020	0.000	0.02		0.020	0.00		1.5
70/05/18	13 40		0.28	0.070	0.020	0.010	0.18		0.100	0.01		2.0
70/06/16	09 20		0.20	0.080	0.030	0.000	0.09		0.060	0.06		0.5
70/07/14	12 45		0.08	0.040	0.010	0.010	0.02		0.130	0.11	0.100	1.0
70/08/17	16 00		0.07	0.060	0.010	0.000	0.00		0.050	0.05	0.050	
70/09/22	09 15		0.08	0.070	0.010	0.000	0.00		0.090	0.09	0.080	1.5
70/10/20	13 20		0.04	0.000	0.020	0.000	0.02	0.1	0.120	0.11	0.110	2.5
70/11/17	09 10		0.11	0.000	0.020	0.000	0.09	0.4	0.200	0.20	0.180	0.5
70/12/15	08 00		0.16	0.010	0.050	0.010	0.09	0.4	0.180	0.18	0.160	1.5
71/01/20	07 15		0.14	0.020	0.020	0.010	0.09	0.4		0.20	0.190	1.5
71/02/24	09 30		0.50	0.020	0.170	0.010	0.20	0.2		0.13	0.080	1.0
71/03/24	09 15		1.10	0.040	0.930	0.000	0.10	0.1	0.150	0.10	0.150	2.0
71/04/20	09 00		0.41	0.220	0.090	0.000	0.10	0.1	0.060	0.050	0.040	2.0
71/05/25	13 20		0.45	0.240	0.110	0.000	0.10	0.1	0.110	0.080	0.050	3.5
71/06/22	08 35		0.52	0.430	0.090	0.000	0.00	0.04	0.050	0.020	0.020	1.0
71/07/27	08 35		0.17	0.000	0.170	0.000	0.00	0.0	0.070	0.060	0.040	0.0
71/08/18	13 45		0.35	0.240	0.110	0.000	0.00	0.0	0.060	0.050	0.020	
71/09/22	09 05		0.28	0.090	0.140	0.000	0.05	0.05	0.070	0.060	0.030	
71/10/19	09 45		0.24	0.050	0.170	0.000	0.02	0.02	0.120	0.110	0.050	0.5
71/11/16	12 50		1.10	0.310	0.090	0.000	0.68	0.7	0.150	0.090	0.070	
71/12/07	13 10		0.25	0.200	0.050	0.000	0.00	0.0	0.130	0.100	0.060	
72/01/10	10 00		0.60	0.290	0.070	0.000	0.24	0.2	0.180	0.160	0.130	1.5
72/02/03	14 30		0.46	0.200	0.050	0.000	0.21	0.2	0.120	0.110	0.110	
72/03/02	08 35		2.30	0.200	0.100	0.000	2.00	2.0	0.110	0.060	0.020	

TABLE 39.4 CHEMICAL DATA

KOOTENAI RIVER AT LEONIA, IDAHO

DATE FROM TO	TIME OF DAY	DEPTH FEET	00915 CALCIUM CA, DISS MG/L	00925 MGNSIUM MG,DISS MG/L	00930 SODIUM NA,DISS MG/L	00935 PTSSIUM K,DISS MG/L	00940 CHLORIDE CL MG/L	00945 SULFATE SO4-TOT MG/L	00950 FLUORIDE F,DISS MG/L	00955 SILICA DISOLVED MG/L
68/03/13	11 00					1.00				7.8
68/04/03	10 45				2.50		2	30		8.7
68/04/17	13 30				2.50	0.90	1	45		7.9
68/05/08	13 30				1.80	0.80	1	38		7.1
68/06/04	11 05				1.40	0.60	1	31		5.2
68/07/10	08 10				1.00	0.50	2	33		4.4
68/08/06	14 00				2.90	0.80	2	27		3.0
68/08/20	09 45				2.10	0.60	1	44		3.4
68/11/12	13 15				2.00	0.60	2	26		6.6
69/02/12	09 30				3.80	0.75	2	27		7.0
68/03/18	18 00				3.00	0.69	2	34		7.5
69/05/27	22 00						< 1	10		7.0
69/08/19	20 00				2.80	0.70	3	30		
69/09/17	13 30				3.40	0.80				
69/10/20	17 00					0.90	4			
69/11/18	12 55					0.90	4			
69/12/16	14 20		40.0	13.0	4.10	0.40	4	33		7.0
70/01/28	10 25		38.0	13.0	4.60	1.00	6	36		7.0
70/02/25	14 05						4			
70/03/24	14 30						5			
70/04/27	13 05		31.0	9.6	3.70	0.90	3	20		7.7
70/05/18	13 40						2			
70/06/16	09 20		25.0	6.2	1.60	0.70	2	13		5.7
70/07/14	12 45		31.0	8.6	2.30	1.40	4	19	0.40	4.1
70/09/22	09 15						4	34	0.70	
70/10/20	13 20		40.0	12.0			3	32	0.70	
71/01/20	07 15		31.0	9.0			3	24	0.60	8.8
71/04/20	09 00		28.0	6.9			1	20	0.40	
71/07/27	08 35		25.0	7.1			2	16	0.30	
71/08/18	13 45		32.0	8.6	2.60	0.60	4	20	0.50	
71/09/22	09 45		38.0	11.0	3.50	0.70	3	33	0.70	
71/10/19	09 45		37.0	11.0	3.90	0.50	5	3	1.10	
71/11/16	12 50		37.0	11.0	4.10	0.80	3	33	1.00	
71/12/07	13 10		41.0	12.0	4.60	0.60	4	33	0.50	
72/01/10	10 00		41.0	12.0	4.30	1.10	4	32	1.30	
72/02/03	14 30		43.0	13.0	4.80	0.80	5	30	0.50	
72/03/02	08 35		20.0	5.8	2.70	0.80	2	13	0.20	

TABLE 39.6 CHEMICAL DATA

KOOTENAI RIVER AT LEONIA, IDAHO

DATE FROM TO	TIME OF DAY	01106 ALUMINUM AL,DISS UG/L	01130 LITHIUM LI,DISS UG/L	01145 SELENIUM SE,DISS UG/L	31501 TOT COLI MFIMENDO /100 ML	31503 TOT COLI MFDLENDO /100 ML	71890 MERCURY HG,DISS UG/L	71900 MERCURY HG,TOTAL UG/L	31503 TOT COLI MFDLENDO /100 ML	31616 FEC COLI MFM-FCBR /100 ML	38260 MBAS MG/L
68/03/13	11 00					560			560		
68/04/03	10 45					740			740		
68/04/17	13 30					1120			1120		
68/05/08	13 30					680			680		
68/06/04	11 05					2300			2300		
68/07/10	08 10					480			480		
68/08/06	14 00					55			55		
68/08/20	09 45					205			205		
68/11/12	13 15					2500			2500		
69/02/12	09 30					1040			1040		
69/05/27	22 00					1300			1300		
69/08/19	20 00					60			60		
69/10/20	17 00				40						
69/11/18	12 55				500						
69/12/16	14 20				1600						
70/01/28	10 25				490						
70/02/25	14 05				16						
70/03/24	14 30				190						
70/04/27	13 05				270						
70/05/18	13 40									40	
70/06/16	09 20				810					77	
70/07/14	12 45				88					2	
70/08/17	16 00				52					1	
70/09/22	09 15				970					100	
70/10/20	13 20				150					35	
70/11/17	09 10				< 1000					1000	
70/12/15	08 00				610					540	
71/01/20	07 15				470					260	
71/02/24	09 30				310					180	
71/03/24	09 15				70						
71/04/20	09 00				300						
71/05/25	13 20				2100					69	
71/06/22	08 35				3200			0.4		58	
71/07/27	08 35				3300					33	
71/08/18	13 45				1000		0.0				
71/09/22	09 05				150		0.0			2	
71/10/19	09 45				210		0.2				
71/11/16	12 50				950		2.4			98	
71/12/07	13 10				170		0.0			15	
72/01/10	10 00			2	1100		0.4			48	
72/02/03	14 30				260		0.3			15	
72/03/02	08 35				570		0.3			73	

APPENDIX

TABLE 40.1 CHEMICAL DATA

KOOTENAI RIVER AT COPELAND IDAHO

DATE FROM TO	TIME OF DAY	00010 WATER TEMP CENT	00060 STREAM FLOW CFS	00070 TURB JKSN JTU	00080 COLOR PT-CO UNITS	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00310 BOD 5 DAY MG/L	00400 PH SU	00405 CO2 MG/L
69/05/27	23 30	10.5		32.0	25	150	10.9	105.0		7.70	2.5
69/08/19	18 30	17.7		1.0	5	250	9.4	105.0		8.00	2.1
69/09/17	15 00	15.6				300	9.3	98.0		8.20	1.4
69/10/20	13 30	5.5	5840	2.0	5	280	12.0	101.0	2.0	8.60	0.5
69/11/18	09 30	4.0	5200	2.0	5	261	12.6	102.0	2.2	6.60	41.7
69/12/16	10 35	0.0	4370	2.0	5	278	13.1	95.0	1.5	8.20	1.5
70/01/27	10 20	0.5	3960	1.0	0	282	13.0	96.0	1.3	8.30	1.1
70/02/25	08 55	0.0	4190	2.0	5	266	13.4	99.0	2.3	8.10	1.7
70/03/24	09 50	5.0	4560	2.0	5	276	11.8	99.0	0.6	8.20	1.3
70/04/27	10 05	7.5	7460	0.0	5	208	11.2	98.0	1.5	8.20	1.0
70/05/18	11 15	10.5	33400	6.0	10	129	10.8	103.0	1.5	8.20	0.7
70/06/16	12 30	11.2	35000	3.0	5	169	11.0	108.0	2.2	8.10	1.2
70/07/14	10 15	18.2	15000	2.0	5	221	9.0	101.0	0.3	8.50	0.6
70/08/17	12 30	19.5	6540	0.0		243	9.4	110.0	1.4	8.50	0.6
70/09/22	12 10	10.0	6440	1.0	5	283	11.3	107.0	1.0	8.60	0.5
70/10/20	09 00	7.0	4610	10.0	0	262	12.4	109.0	2.3	7.70	4.0
70/11/17	13 15	4.0	4190			295	14.3	117.0	3.2	7.10	18.9
70/12/15	14 10	0.0				258	14.8	108.0	1.0	7.80	3.2
71/01/20	13 30	0.0	6250		3	291	14.3	104.0	1.0	8.30	1.1
71/02/24	13 10	2.0	6750			212	13.2	101.0	3.7	7.30	7.9
71/03/24	12 00	4.5	4630			266	12.7	105.0	2.9	7.80	3.0
71/04/20	13 20	7.5	13900	4.0	5	190	11.7	104.0	2.1	7.80	2.3
71/05/26	08 00	10.0	60500			157	10.9	103.0	0.3	7.30	6.2
71/06/22	11 00	12.5	46200			182	11.7	117.0	2.1	7.00	15.2
71/07/27	10 50	18.0	25900	5.0	5	185	9.7	109.0	0.6	7.60	3.8
71/08/18	09 30	19.0	11000	1.0	5	234	9.1	103.0	0.1	7.20	12.0
71/09/22	11 40	11.5	5340	1.0	3	270	10.8	105.0	2.3	7.30	10.4
71/10/19	13 15	7.0	5720	3.0	5	276	12.0	105.0	1.8	8.30	1.1
71/11/16	08 50	4.0	5570	1.0	5	278	12.5	102.0	1.6	7.80	3.2
71/12/17	09 15	1.0	3240	2.0	5	305	13.0	98.0	0.1	7.30	10.9
72/01/10	13 15	0.0	3000	1.0	3	311	13.7	100.0	1.1	7.70	4.5
72/02/03	10 00	0.0	2840	2.0	5	281	13.5	98.0	1.5	6.80	35.0
72/03/02	11 15	0.0	13500	30.0	10	137	13.4	98.0	1.3	6.00	105.6

TABLE 40.2 CHEMICAL DATA

KOOTENAI RIVER AT COPELAND, IDAHO

DATE FROM TO	TIME OF DAY	70300 RESIDUE DISS-180 C MG/L	70301 DISS SOL SUM MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L	00445 CO3 ION CO3 MG/L	00900 TOT HARD CACO3 MG/L	00902 NC HARD CACO3 MG/L
69/05/27	23 30			67	8		80	14
69/08/19	18 30			108	132		135	29
69/09/17	15 00			114	139			
69/10/20	13 30	165		103	126	6	135	22
69/11/18	09 30	153		101	123	0	138	37
69/12/16	10 35	188		122	149	0	152	30
70/01/27	10 20	186		117	143	0	142	25
70/02/25	08 55	160		110	134	0	133	23
70/03/24	09 50	155		107	130	0	141	34
70/04/27	10 05	120		85	104	0	103	18
70/05/18	11 15	91		56	68	0	64	8
70/06/16	12 30	100		74	90	0	87	13
70/07/14	10 15	132		93	109	2	110	17
70/08/17	12 30	149		102	116	4		
70/09/22	12 10	164		110	134	2	140	30
70/10/20	09 00	169		108	132	0	140	32
70/11/17	13 15	175		119	145	0		
70/12/15	14 10	156		105	128	0		
71/01/20	13 30	170		114	139	0	150	36
71/02/24	13 10	120		82	100	0		
71/03/24	12 00	140		100	122	0	130	30
71/04/20	13 20	88		75	92	0	90	0
71/05/26	08 00	102		65	79	0	69	0
71/06/22	11 00	142		78	95	0		
71/07/27	10 50	114		79	96	0	85	6
71/08/18	09 30			98	120	0	112	0
71/09/22	11 40			108	132	0	130	0
71/10/19	13 15			110	134	0	135	25
71/11/16	08 50			105	128	0	130	25
71/12/07	09 15			113	138	0	143	29
72/01/10	13 15			122	149	0	150	28
72/02/03	10 00			114	139	0	140	26
72/03/02	11 15			54	66	0	65	10

TABLE 40.3 CHEMICAL DATA

KOOTENAI RIVER AT COPELAND, IDAHO

DATE FROM TO	TIME OF DAY	DEPTH FEET	00600 TOTAL N N MG/L	00605 ORG N N MG/L	00610 NH3-N TOTAL MG/L	00613 NO2-N DISS MG/L	00618 NO3-N DISS MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P	00671 PHOS-DIS ORTHO MG/L P	00680 T ORG C C MG/L
69/05/27	23 30		0.16	0.040	0.060	0.050	0.10		0.150		0.023	
69/08/19	18 30		0.43	0.380	0.020	0.010	0.02		0.055		0.048	
69/09/17	15 00		0.44	0.390	0.010	<0.001	0.04		0.048		0.036	14.0
69/10/20	13 30		0.07	0.060	0.010	0.000	0.00		0.040	0.03		1.5
69/11/18	09 30		0.20	0.100	0.080	0.000	0.02		0.070	0.07		5.0
69/12/16	10 35		0.15	0.010	0.070	0.000	0.07		0.010	0.00		2.5
70/01/27	10 20		0.17	0.040	0.030	0.010	0.09		0.030	0.01		1.5
70/02/25	08 55		0.24	0.000	0.000	0.010	0.23		0.020	0.02		1.5
70/03/24	09 50		0.14	0.050	0.000	0.000	0.09		0.020	0.01		2.5
70/04/27	10 05		0.02	0.000	0.000	0.000	0.02		0.030	0.01		3.0
70/05/18	11 15		0.18	0.060	0.020	0.010	0.09		0.080	0.03		1.5
70/06/16	12 30		0.19	0.080	0.020	0.000	0.09		0.090	0.06		0.5
70/07/14	10 15		0.13	0.060	0.050	0.000	0.02		0.110	0.08	0.080	1.5
70/08/17	12 30		0.07	0.070	0.000	0.000	0.00		0.060	0.06	0.060	
70/09/22	12 10		0.08	0.050	0.000	0.010	0.02		0.110	0.07	0.070	0.0
70/10/20	09 00		0.09	0.010	0.060	0.000	0.02	0.1	0.150	0.14	0.130	0.0
70/11/17	13 15		0.09	0.010	0.030	0.000	0.05	0.2	0.200	0.170	0.100	1.0
70/12/15	14 10		0.14	0.000	0.030	0.020	0.09	0.4	0.150	0.15	0.130	1.0
71/01/20	13 30		0.20	0.020	0.070	0.020	0.09	0.5		0.000	0.000	1.5
71/02/24	13 10		0.29	0.020	0.070	0.010	0.19	0.2	0.110	0.070	0.100	2.0
71/03/24	12 00				0.110	0.000	0.10	0.1	0.110	0.10	0.080	1.0
71/04/20	13 20		0.36	0.180	0.080	0.000	0.10	0.1	0.050	0.020	0.040	2.0
71/05/26	08 00		0.41	0.150	0.160	0.000	0.10	0.1	0.100	0.060	0.040	3.0
71/06/22	11 00		0.59	0.400	0.090	0.000	0.10	0.05	0.050	0.020	0.020	1.0
71/07/27	10 50		3.10	2.900	0.210	0.000	0.00	0.01	0.080	0.070	0.040	1.0
71/08/18	09 30		0.36	0.290	0.070	0.000	0.00	0.00	0.060	0.050	0.020	
71/09/22	11 40		0.21	0.120	0.070	0.000	0.02	0.02	1.100	0.080	0.040	
71/10/19	13 15		0.21	0.010	0.200	0.000	0.00	0.00	0.120	0.110	0.060	0.0
71/11/16	08 50		0.67	0.040	0.190	0.000	0.44	0.4	0.140	0.130	0.080	
71/12/07	09 15		0.16	0.140	0.020	0.000	0.00	0.0	0.130	0.130	0.090	
72/01/10	13 15		0.48	0.200	0.070	0.000	0.21	0.2	0.110	0.090	0.060	1.0
72/02/03	10 00		0.59	0.230	0.070	0.000	0.29	0.3	0.150	0.140	0.130	
72/03/02	11 15		0.58	0.200	0.120	0.000	0.26	0.3	0.120	0.050	0.020	

TABLE 40.4 CHEMICAL DATA

KOOTENAI RIVER AT COPELAND, IDAHO

DATE FROM TO	TIME OF DAY	DEPTH FEET	00915 CALCIUM CA, DISS MG/L	00925 MGNSIUM MG,DISS MG/L	00930 SODIUM NA,DISS MG/L	00935 PTSSIUM K,DISS MG/L	00940 CHLORIDE CL MG/L	00945 SULFATE SO4-TOT MG/L	00950 FLUORIDE F,DISS MG/L	00955 SILICA DISOLVED MG/L
69/05/27	23 30						1	14		7.5
69/08/19	18 30				2.70	0.80	3	25		4.6
69/09/17	15 00				3.20	0.90				3.9
69/10/20	13 30					0.80	5			
69/11/18	09 30					1.00	4			
69/12/16	10 35		40.0	12.0	4.10	0.60	4	37		7.9
70/01/27	10 20		38.0	11.0	4.60	1.10	4	53		7.2
70/02/25	08 55						3			
70/03/24	09 50						4			
70/04/27	10 05		28.0	8.1	3.50	0.90	4	25		9.0
70/05/18	11 15						2			
70/06/16	08 50		24.0	6.0	1.60	0.70	2	13		6.2
70/07/14	10 15		31.0	8.3	2.20	1.60	3	18	0.30	4.0
70/09/22	12 10						4	30	0.60	
70/10/20	09 00		38.0	11.0			3	33	0.60	
70/11/17	13 15					1.60				
71/01/20	13 30		39.0	12.0		1.00	3	29	0.60	9.4
71/03/24	12 00		35.0	11.0		1.00				
71/04/20	13 20		25.0	6.7			1	19		
71/05/26	08 00		20.0	4.6		0.50				
71/07/27	10 50		23.0	6.6	1.50	0.50	2	14	0.20	
71/08/18	09 30		31.0	8.4	2.50	0.60	3	19	0.50	
71/09/22	11 40		35.0	11.0	3.10	0.80	3	32	0.70	
71/10/19	13 15		36.0	11.0	3.60	0.30	4	29	0.90	
71/11/16	08 50		35.0	10.0	3.80	0.90	3	29	0.80	
71/12/07	09 15		39.0	11.0	4.00	0.90	4	30	1.10	
72/01/10	13 15		41.0	12.0	4.00	1.10	4	31	0.40	
72/02/03	10 00		38.0	12.0	4.40	0.90	4	26	0.80	
72/03/02	11 15		18.0	4.9	2.40	0.80	2	13	0.30	

APPENDIX

TABLE 40.5 CHEMICAL DATA

KOOTENAI RIVER AT COPELAND, IDAHO

DATE FROM TO	TIME OF DAY	01000 ARSENIC AS,DISS UG/L	01002 ARSENIC AS,TOT UG/L	01005 BARIUM BA,DISS UG/L	01010 BERYLIUM BE,DISS UG/L	01020 BORON B,DISS UG/L	01022 BORON B,TOT UG/L	01025 CADMIUM CD,DISS UG/L	01027 CADMIUM CD,TOT UG/L	01030 CHROMIUM CR,DISS UG/L	01032 CHROMIUM HEX-VAL UG/L	01034 CHROMIUM CR,TOT UG/L
69/11/18	09 30	5		200	0.00	0		3		2		
70/01/27	10 20	3		0	0.00	20		3		0		
70/04/27	10 05	1		0	0.00	20		1		0		
70/05/18	11 15	0		0	0.00	10		1		0		
70/07/14	10 15	2		0	0.00	0		3		0		
70/09/22	12 10		< 10				20		< 1			
70/10/20	09 00	0										1
70/11/17	13 15	0		0	10.00	0	20	3				1
70/12/15	14 10						< 10					
71/01/20	13 30	0		10	0.00	20	< 10	0				2
71/03/24	12 00	10		400	5.00	10	< 10					1
71/05/26	08 00	0		0	0.00	10		0		0		
71/07/27	10 50		< 1	1000	0.00	10		1	< 1	1		1
71/10/19	13 15	0	8					0	3	2		2
72/01/10	13 15	0	3					1	< 1	0		< 1

TABLE 40.6 CHEMICAL DATA

KOOTENAI RIVER AT COPELAND, IDAHO

DATE FROM TO	TIME OF DAY	01035 COBALT CO,DISS UG/L	01037 COBALT CO,TOTAL UG/L	01040 COPPER CU,DISS UG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01046 IRON FE,DISS UG/L	01049 LEAD PB,DISS UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01056 MANGNESE MN,DISS UG/L
69/11/18	09 30	2		30			20	11			20.0
70/01/27	10 20	3		4			40	23			30.0
70/04/27	10 05	2		5			20	7			20.0
70/05/18	11 15	3		4			40	8			0.0
70/07/14	10 15	3		8			10	7			0.0
70/09/22	12 10				10	200			< 1	20.0	
70/11/17	13 15	0		1	10	120	40	0	5	10.0	0.0
70/12/15	14 10				10	120			60	20.0	
71/01/20	13 30	0		0	10	< 10	200	0	< 1	10.0	0.0
71/03/24	12 00	2		0	10	170	60	2	12	40.0	390.0
71/05/26	08 00	0		2	10	1300	70	3	9	50.0	80.0
71/07/27	10 50	0		1	< 10	30	10	0	2		10.0
71/08/18	09 30			0			20	0			
71/09/22	11 40			0			20	3			
71/10/19	13 15			1	< 1		10	0	< 1		
71/11/16	08 50			1			40	2			
71/12/07	09 15			0			20	0			
72/01/10	13 15			1	< 1		20	1	< 1		
72/02/03	10 00			2			50	14			
72/03/02	11 15			2			50	5			

APPENDIX

TABLE 40.7 CHEMICAL DATA

KOOTENAI RIVER AT COPELAND, IDAHO

DATE FROM TO	TIME OF DAY	01060 MOLY MO,DISS UG/L	01065 NICKEL NI,DISS UG/L	01075 SILVER AG,DISS UG/L	01080 STRONTUM SR,DISS UG/L	01082 STRONTUM SR,TOT UG/L	01085 VANADIUM V,DISS UG/L	01090 ZINC ZN,DISS UG/L	01092 ZINC ZN,TOT UG/L
69/11/18	09 30	2	9	0.0	160		0	30	
70/01/27	10 20	3	10	1.0	180		1	10	
70/04/27	10 05	0	6	10.0	120		0	10	
70/05/18	11 15	0	4	5.0	90		0	10	
70/07/14	10 15	2	5	1.0	200		0	10	
70/09/22	12 10								30
70/10/20	09 00						0.4		
70/11/17	13 15	0	7	0.0		140	0.3	0	20
70/12/15	14 10					90			20
71/01/20	13 30		0	1.0		100	0	40	50
71/03/24	12 00	0	7			100	0	60	30
71/05/26	08 00	2	3			60	0.2	50	30
71/07/27	10 50	2	4	0.0	80		2.2	80	10
71/08/18	09 30							170	
71/09/22	11 40							30	
71/10/19	13 15						0	10	< 10
71/11/16	08 50							140	
71/12/07	09 15							10	
72/01/10	13 15						0.8	30	10
72/02/03	10 00							20	
72/03/02	11 15							20	

TABLE 40.8 CHEMICAL DATA

KOOTENAI RIVER AT COPELAND, IDAHO

DATE FROM TO	TIME OF DAY	01106 ALUMINUM AL,DISS UG/L	01130 LITHIUM LI,DISS UG/L	01145 SELENIUM SE,DISS UG/L	31501 TOT COLI MFIMENDO /100 ML	31503 TOT COLI MFDLENDO /100 ML	71890 MERCURY HG,DISS UG/L	71900 MERCURY HG,TOTAL UG/L	31503 TOT COLI MFDLENDO /100 ML	31616 FEC COLI MFM-FCBR /100 ML	38260 MBAS MG/L
69/05/27	23 30					1400			1400		
69/08/19	18 30					100			100		
69/11/18	09 30	60		2	69						
69/12/16	10 35				100						
70/01/27	10 20	100		0	84						
70/02/25	08 55				63						
70/03/24	09 50				50						
70/04/27	10 05	0		2	60						
70/05/18	11 15	100		2						14	
70/06/16	12 30				680					36	
70/07/14	10 15	100		1	38					4	
70/08/17	12 30				370					1	
70/09/22	12 10				330		0.1			17	
70/10/20	09 01				140					100	
70/11/17	13 15	0		9				0.3		80	
70/12/15	14 10				1100		0.5	0.2		215	
71/01/20	13 30	300		13	220		0.5	0.3		93	
71/02/24	13 10				96					70	
71/03/24	12 00	500		0	33		0.5				
71/04/20	13 20				180		0.5				
71/05/26	08 00	600		10	2400		0.5			49	
71/06/22	11 00				2400					11	
71/07/27	10 50	500	8	2	1100		0.1			1	
71/08/18	09 30				350		0.1				
71/09/22	11 40				39		0.1			5	
71/10/19	13 15				70		0.1				
71/11/16	08 50				130		0.6			5	
71/12/07	09 15				17		0.1			1	
72/01/10	13 15			3	380		0.4			9	
72/02/03	10 00				180		0.3			8	
72/03/02	11 15				60		3.1			24	

TABLE 41.1 CHEMICAL DATA

KOOTENAI RIVER AT PORTHILL, IDAHO

DATE FROM TO	TIME OF DAY	00010 WATER TEMP CENT	00060 STREAM FLOW CFS	00070 TURB JKSN JTU	00080 COLOR PT-CO UNITS	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00310 BOD 5 DAY MG/L	00400 PH SU	00405 CO2 MG/L
68/03/13	08 45	4.5				260	13.0	107.0		7.80	2.0
68/04/03	08 55	6.0		2.0	10	235	11.8	101.0		7.80	2.0
68/04/17	14 00	8.0		2.0	10	295	11.7	104.0		8.20	0.9
68/05/08	15 15	10.0		3.0	10	200	11.0	103.0		7.60	2.9
68/06/04	09 25	12.0		11.0	10	160	11.0	108.0		7.80	1.8
68/07/10	09 45	18.0		1.0	8	190	9.3	105.0		8.10	1.2
68/08/06	12 00	19.2		1.0	2	205	8.2	93.0		8.10	1.4
68/08/20	07 45	15.5		< 1.0	< 5	240	9.1	96.0		7.70	3.6
68/09/24	21 45	11.2		1.0	5	260	10.2	98.0		8.30	0.8
68/11/12	11 45	4.5		1.0	5	220	11.8	97.0		7.60	4.0
68/12/16	20 05	2.5		< 1.0	5	235	13.1	102.0		7.80	2.7
69/02/12	07 20	1.0		1.0	5	220	13.0	97.0		7.50	6.3
69/03/18	16 30	1.5		5.0	3	330	13.0	98.0		8.00	2.1
69/04/22	12 00	8.0		23.0	15	170	12.1	108.0		7.60	3.2

TABLE 41.2 CHEMICAL DATA

KOOTENAI RIVER AT PORTHILL, IDAHO

DATE FROM TO	TIME OF DAY	70300 RESIDUE DISS-180 C MG/L	70301 DISS SOL SUM MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L	00445 CO3 ION CO3 MG/L	00900 TOT HARD CACO3 MG/L	00902 NC HARD CACO3 MG/L
68/03/13	08 45			65	79			
68/04/03	08 55			66	80		105	
68/04/17	14 00			76	93		123	
68/05/08	15 15			59	72		100	
68/06/04	09 25			60	73		113	
68/07/10	09 45			79	96		148	
68/08/06	12 00			89	109		228	
68/08/20	07 45			98	119		256	
68/09/24	21 45			84	102		131	
68/11/12	11 45			82	100		111	
68/12/16	20 05			88	107		99	
69/02/12	07 20			108	132		125	
69/03/18	16 30			107	130		134	
69/04/22	12 00			65	79		75	

TABLE 41.3 CHEMICAL DATA

KOOTENAI RIVER AT PORTHILL IDAHO

DATE FROM TO	TIME OF DAY	DEPTH FEET	00600 TOTAL N N MG/L	00605 ORG N N MG/L	00610 NH3-N TOTAL MG/L	00613 NO2-N DISS MG/L	00618 NO3-N DISS MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P	00671 PHOS-DIS ORTHO MG/L P	00680 T ORG C C MG/L
68/03/13	08 45					<0.010	0.11		0.290		0.250	
68/04/03	08 55		.80	.60	0.100	0.006	0.09		0.240		0.200	
68/04/17	14 00		.21	.10	<0.100	0.001	0.01		0.330		0.250	
68/05/08	15 15		.30	.10	<0.100	<0.010	0.09		0.150		0.110	
68/06/04	09 25		.48	.30	0.100	0.001	0.08		0.200		0.067	8.0
68/07/10	09 45		.48	.35	<0.050	<0.005	0.07		0.160		0.110	1.0
68/08/06	12 00		.21	.19	<0.010	<0.005	0.005		0.090		0.053	3.0
68/08/20	07 45		.12	.09	<0.010	<0.005	0.01		0.220		0.220	1.0
68/09/24	21 45		.22	.20	<0.005	0.005	0.05		0.240		0.200	2.0
68/11/12	11 45		.26	.19	0.010	<0.010	<0.05		0.072		0.050	<1.0
68/12/16	20 05		.44	.38	0.020	<0.020	0.20		0.170		0.160	3.0
69/02/12	07 20		.92	.69	0.010	<0.010	0.21		0.180		0.180	1.0
69/03/18	16 30		.44	.19	0.010	<0.005	0.25		0.130		0.093	<1.0
69/04/22	12 00		.56	.28	0.120	0.010	0.15		0.110		0.022	2.0

TABLE 41.4 CHEMICAL DATA

KOOTENAI RIVER AT PORTHILL, IDAHO

DATE FROM TO	TIME OF DAY	00915 CALCIUM CA,DISS MG/L	00925 MGNSIUM MG,DISS MG/L	00930 SODIUM NA,DISS MG/L	00935 PTSSIUM K,DISS MG/L	00940 CHLORIDE CL MG/L	00945 SULFATE SO4-TOT MG/L	00950 FLUORIDE F,DISS MG/L	00955 SILICA DISOLVED MG/L	00956 SILICA TOTAL UG/L	00956 SILICA TOTAL UG/L
68/03/13	08 45				1.00					9.2	9.2
68/04/03	08 55			2.50	0.90	2	30			9.7	9.7
68/04/17	14 00			2.80	0.80	1	43			8.7	8.7
68/05/08	15 15			1.80	0.90	1	32			7.7	7.7
68/06/04	09 25			1.40	0.50	1	23			5.2	5.2
68/07/10	09 45			1.00	0.80	2	24			4.7	4.7
68/08/06	12 00			1.80	0.60	2	25			3.2	3.2
68/08/20	07 45			2.20	0.60	2	37			5.5	5.5
68/09/24	21 45			2.20	0.70	2	37				
68/11/12	11 45			2.10	0.60	2	25				6.2
68/12/16	20 05			2.30	0.60	1	58				7.5
69/02/12	07 20			3.60	0.80	2	24				8.0
69/03/18	16 30			3.30	0.77	2	34				8.4
69/04/22	12 00			1.80	0.82	1	16				10.0

TABLE 41.5 CHEMICAL DATA

KOOTENAI RIVER AT PORTHILL, IDAHO

DATE FROM TO	TIME OF DAY	01106 ALUMINUM AL,DISS UG/L	01130 LITHIUM LI,DISS UG/L	01145 SELENIUM SE,DISS UG/L	31501 TOT COLI MFIMENDO /100 ML	31503 TOT COLI MFDLENDO /100 ML	71890 MERCURY HG,DISS UG/L	71900 MERCURY HG,TOTAL UG/L	31503 TOT COLI MFDLENDO /100 ML	31616 FEC COLI MFM-FCBR /100 ML	38260 MBAS MG/L
68/03/13	08 45					310			310		
68/04/03	08 55					460			460		
68/04/17	14 00					740			740		
68/05/08	15 15					740			740		
68/06/04	09 25					940			940		
68/07/10	09 45					420			420		
68/08/06	12 00					10			10		
68/08/20	07 45					402			402		
68/09/24	21 45					680			680		
68/11/12	11 45					180			180		
68/12/16	20 05					460			460		
69/02/12	07 20					660			660		
69/04/22	12 00					980			980		

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TABLE 42.1 COMPOSITED WATER QUALITY DATA, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DATE	DIS-CHARGE (CFS)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)	DIS-SOLVED SODIUM (NA) (MG/L)	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)
OCT.												
03-15	5070	6.1	--	61	12	3.4	1.0	140	0	85	1.9	1.4
16-24	4840	6.0	--	60	12	3.1	.6	138	0	82	2.2	1.4
25-31	4830	5.7	--	58	12	3.0	.6	142	0	78	1.9	1.3
NOV.												
01-03	4830	5.7	--	58	12	3.0	.6	142	0	78	1.9	1.3
04-10	4620	5.2	--	40	11	3.0	.8	136	0	38	1.8	.4
11-26	4080	6.3	--	65	13	3.2	1.0	144	0	92	2.1	1.6
27-30	3060	7.1	--	70	14	3.5	.8	158	0	101	2.1	1.5
DEC.												
01-13	3270	7.4	--	72	14	3.5	.9	152	0	106	3.6	1.9
14-31	2660	8.4	--	82	15	3.7	.9	160	0	126	3.2	2.3
JAN.												
01-14	2750	8.9	--	81	15	3.8	.7	160	0	128	3.0	2.1
15-31	3350	9.2	--	79	14	3.7	1.2	164	0	117	3.2	2.3
FEB.												
01-26	3240	8.0	--	79	14	3.8	.8	152	0	125	3.4	2.3
27-29	3630	7.2	--	73	13	3.3	.9	140	0	113	2.0	2.0
MAR.												
01-26	3630	7.2	--	73	13	3.3	.9	140	0	113	2.0	2.0
27-31	3950	6.1	--	67	12	3.2	1.0	143	0	94	2.0	1.5
APR.												
01-08	3950	6.1	--	67	12	3.2	1.0	143	0	94	2.0	1.5
09-30	3980	5.7	--	67	12	3.4	.8	143	0	98	1.9	1.8
MAY												
01-12	11400	6.2	--	43	8.5	2.1	.8	115	0	50	1.4	.9
13-31	31400	5.1	--	35	6.8	1.4	.6	104	0	26	.8	.5
JUNE												
01-30	42100	3.5	--	30	6.2	1.4	.3	104	0	22	.6	.5
JULY												
01-14	30400	4.2	--	29	6.5	1.2	.5	98	0	23	.6	.4
15-31	16900	4.5	--	33	8.6	1.8	.9	111	0	30	1.1	.4
AUG.												
01-18	10800	4.2	--	36	9.2	2.1	.5	120	0	32	1.7	.4
19-31	8710	5.0	--	48	10	2.4	1.0	130	0	60	1.9	1.1
SEP.												
01-17	7130	6.1	--	52	11	2.6	.7	130	0	71	1.8	1.3
18-30	8030	6.6	--	40	10	2.2	.4	125	0	41	1.5	1.2
WTD. AVG.	--	4.9	--	41	8.4	1.9	.6	115	0	43	1.3	.8
TIME WTD. AVG.	11100	6.2	--	57	11	2.8	.8	134	0	76	2.0	1.4
TONS PER DAY (SHORT)	--	146	--	1210	290	58	17	3450	0	1290	38	24

12301933 - KOOTENAI R. BL LIBBY DAM NR LIBBY, MONT.

TABLE 42.2 COMPOSITED WATER QUALITY DATA, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DATE	DIS_ SOLVED NITRATE (NO3) (MG/L)	DIS- SOLVED BORCN (B) (UG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)	DIS- SOLVED SOLIDS (TONS PER DAY)	HARD- NESS (CA,MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	SODIUM AD- SORP- TION RATIO	SPF- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH (UNITS)	CULOR (PLAT- INUM- COBALT UNITS)
OCT.											
03-15	.2	20	252	.34	3450	203	88	.1	406	7.9	2
16-24	.1	20	240	.33	3140	200	87	.1	390	8.0	4
25-31	.1	10	239	.33	3120	196	80	.1	389	7.8	5
NOV.											
01-03	.1	10	239	.33	3120	196	80	.1	389	7.8	5
04-10	.1	10	185	.25	2310	147	35	.1	305	7.8	4
11-26	.0	0	315	.43	3470	215	97	.1	419	7.8	4
27-30	.2	20	305	.41	2520	230	10C	.1	449	8.1	4
DEC.											
01-13	.0	30	294	.40	2600	236	111	.1	451	7.5	6
14-31	.C	30	330	.45	2370	265	134	.1	5C2	7.5	6
JAN.											
01-14	.0	0	329	.45	2440	263	132	.1	496	7.4	7
15-31	.0	30	318	.43	2880	255	121	.1	485	7.6	7
FEB.											
01-26	.0	10	333	.45	2910	254	129	.1	483	7.6	--
27-29	.3	10	299	.41	2930	234	119	.1	456	7.6	4
MAR.											
01-26	.3	10	299	.41	2930	234	119	.1	456	7.6	4
27-31	.2	0	274	.37	2920	217	99	.1	422	7.9	3
APR.											
C1-08	.2	0	274	.37	2920	217	99	.1	422	7.9	3
09-30	.1	0	277	.38	2980	218	101	.1	433	7.9	3
MAY											
01-12	.1	0	187	.25	5760	142	48	.1	294	8.0	4
13-31	.1	0	136	.18	11500	115	3C	.1	222	8.C	4
JUNE											
01-30	.2	C	121	.16	13800	10C	15	.1	212	7.7	7
JULY											
01-14	.0	0	126	.17	10300	99	19	.1	2C4	7.5	2C
15-31	.0	0	136	.18	6210	118	27	.1	242	7.5	3
AUG.											
01-18	.1	0	156	.21	4550	128	29	.1	268	7.6	1
19-31	.1	0	200	.27	4700	162	55	.1	331	7.7	1
SEP.											
01-17	.1	10	222	.30	4270	173	67	.1	356	7.7	2
18-30	.1	0	163	.22	3530	141	39	.1	289	7.8	1
WTD. AVG.	.1	3	168	.23	--	136	41	.1	274	7.7	--
TIME WTD. AVG.	.1	8	236	.32	--	187	77	.1	369	7.7	--
TONS PER DAY (SHORT)	3.4	0	5010	--	--	--	--	--	--	--	--

PROCESS DATE 05/22/73

12301933 - KOOTENAI R. BL LIBBY DAM NR LIBBY, MONT. DISTRICT CODE 30

TABLE 42.3 COMPOSITED WATER QUALITY DATA, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS-CHARGE (CFS)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)	DIS-SOLVED SODIUM (NA) (MG/L)	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)
OCT.												
01-31	6670	5.4	--	38	11	2.8	1.2	137	0	33	1.6	1.0
NOV.												
01-30	5510	6.1	--	39	11	2.7	.8	142	0	33	2.0	.8
DEC.												
01-28	3740	6.7	--	43	12	3.2	1.9	154	0	39	1.9	.8
FEB.												
04...	2900	7.5	120	46	13	3.4	.9	158	[illegible]	44	2.6	.9
MAR.												
04...	2700	7.2	70	46	13	3.5	.8	160	0	44	2.2	1.1
17-31	3830	7.3	--	44	12	3.7	.9	148	0	44	1.8	1.3
APR.												
01-11	7950	8.9	--	39	10	2.9	.8	132	0	31	.6	.7
12-30	18900	7.8	--	35	8.3	2.1	.8	125	0	21	.7	.4
MAY												
01-09	21400	7.7	--	32	8.3	2.0	.5	126	0	13	3.8	.4
10-31	46300	5.6	--	28	6.3	1.5	.5	114	0	14	.8	.2
JUNE												
01-09	56200	5.0	--	28	6.0	1.3	1.0	114	0	12	.8	.2
10-21	40400	1.9	--	32	6.4	1.4	.7	112	0	19	1.2	.3
22-30	47500	4.6	--	27	6.4	1.4	.4	104	0	15	1.8	.4
JULY												
01-16	33200	4.2	--	31	7.7	2.0	.9	119	0	21	.6	.1
17-31	16500	5.6	--	33	9.8	2.2	.7	134	0	22	1.2	.2
AUG.												
01-31	9130	4.8	--	40	11	3.4	.6	144	0	28	2.6	.3
SEP.												
01-30	6040	5.6	--	42	12	3.5	.8	152	0	35	2.4	.5
WTD. AVG.	--	5.2	--	32	8.0	2.0	.7	123	0	20	1.3	.3
TIME WTD. AVG.	16800	5.8	--	37	9.9	2.6	.9	135	0	28	1.7	.6
TONS PER DAY (SHORT)	--	238	--	1470	361	90	33	5560	0	922	60	16

PROCESS DATE 05/22/73
12301933 - KOOTENAI R. BL LIBBY DAM NR LIBBY, MONT. DISTRICT CODE 30

TABLE 42.4 COMPOSITED WATER QUALITY DATA, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS- SOLVED NITRATE (NO3) (MG/L)	DIS- SOLVED BORON (B) (UG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)	DIS- SOLVED SOLIDS (TONS PER DAY)	HARD- NESS (CA,MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	SODIUM AD- SORP- TION RATIO	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH (UNITS)	COLOR (PLAT- INUM- COBALT UNITS)
OCT.											
01-31	.1	0	170	.23	3060	139	27	.1	285	7.9	3
NOV.											
01-30	.1	0	172	.23	2560	143	27	.1	287	8.0	1
DEC.											
01-28	.1	20	196	.27	1980	157	31	.1	321	8.0	4
FEB.											
04...	.8	40	208	.26	1850	169	40	.1	331	8.0	1
MAR.											
14...	.3	10	211	.29	1570	169	38	.1	335	7.9	2
17-31	.2	10	208	.28	2150	169	39	.1	320	8.2	1
APR.											
01-11	.2	10	184	.25	3950	139	31	.1	273	7.9	15
12-30	.1	10	154	.21	7860	121	19	.1	231	7.9	10
MAY											
01-09	.0	20	156	.21	9010	114	11	.1	239	7.4	2
10-31	.1	0	132	.18	16500	96	2	.1	200	7.7	5
JUNE											
01-09	.0	0	114	.16	17300	95	1	.1	195	8.0	8
10-21	.1	0	123	.17	13400	106	15	.1	208	7.9	2
22-30	.0	0	122	.17	15600	94	8	.1	189	7.5	7
JULY											
01-16	.0	10	137	.19	12300	109	12	.1	233	7.3	3
17-31	.0	20	142	.19	6330	123	13	.1	256	7.7	5
AUG.											
01-31	.0	0	164	.22	4040	146	28	.1	290	7.8	5
SEP.											
01-30	.0	50	180	.24	2940	153	28	.1	305	7.6	7
WTD. AVG.	.1	6	142	.19	--	113	13	.1	231	7.7	--
TIME WTD. AVG.	.1	11	163	.22	--	133	22	.1	268	7.8	--
TONS PER DAY (SHORT)	2.5	0	6440	--	--	--	--	--	--	--	--

Table 43. Physical and Chemical Data Obtained By The U.S. Corps of Engineers From Station 1

Kootenai River near Rexford
Lat. 48° 52' 20" Long. 115° 13' 37"
River Kilometer 419.2
Elevation 689 Meters MSL

DATE: YEAR	MO	DA	TIME	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00094 CNDUCTVY FIELD MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00400 PH SU	00405 CO2 MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L
1969	May	5	1400	8.5	15	272	10.3	96	8.3			
	Jun	3	1120	12.2	51	206	8.7	89	8.4			
	Jun	30		14.0	48	167	9.6	102	7.8			
	Aug	5		15.0	3	258	11.3	122	8.6			
	Sep	2		14.4	2	285	10.2	109	8.6			
	Oct	2		9.0	29	280	10.9	103	8.6	0.6	125	152
	Nov	4		5.5	3	322	12.1	105	7.8	4.1	135	165
	Dec	2	1030	0.5	3	336	13.1	99	8.6	0.5	111	135
1970	Jan	2	1010	0.5	2		12.7	96	8.5			
	Feb	3	1030	1.0	2	356	12.5	96	8.0	2.5	126	154
	Mar	3	1025	0.5	1	375	13.2	100			131	160
	Apr	2	1000	6.0	2	350	11.8	103	8.3	1.1	112	137
	May	5	1150	11.0	53	262	10.3	102	7.9	2.7	110	134
	Jun	5	1130	13.0	94	173	10.2	106	7.8	2.3	75	91
	Jul	10	0945	17.0	3	219	8.6	97	7.9	2.0	82	100
	Aug	3	1345	16.0	3	257	8.4	93				
	Sep	4	1130	13.5	3	275	9.1	95	8.2	1.2	101	123
	Oct	8	1100	5.5	3	290	10.9	94	8.3	1.0	102	124

Table 44. Physical and Chemical Data Obtained By The U.S. Corps of Engineers From Station 2

Kootenai River at Warland
Lat. 48° 30'00" Long. 115° 17' 02"
River Kilometer 367.9
Elevation 657 Meters MSL

DATE: YEAR	MO	DA	TIME	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00094 CONDUCTVY FIELD MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00400 PH SU	00405 CO2 MG/L	00410 T ALK CACO3 MG/L	00440 HCO3ION HCO3 MG/L
1969	Apr	15		7.0	15							
	May	5	1615	9.0	21	210	10.8	101	8.3			
	May	12	1220	8.5	105							
	May	14	1130	8.5	110							
	Jun	3	0840	13.3	43	163	9.8	101	8.3			
	Jun	6	0830	11.1	120							
	Jun	30		14.0	48	165	9.8	103	7.8			
	Aug	3		16.7	13	276	10.0	111	8.6			
	Sep	2		14.4	2	267	9.5	101	8.7			
	Oct	2		10.0	18	276	10.8	104	8.6	0.6	129	157
	Nov	4		5.5	3	322	13.1	112	7.9	3.2	130	158
	Dec	2	1315	0.5	4	336	13.6	102	8.4	0.8	108	132
1970	Jan	2	1150	0.5	2	358	13.6	102	8.6			
	Apr	2	1220	7.0	2	340	12.7	113	8.3	1.0	107	130
	May	5	1310	11.5	43	233	10.5	104	7.8	2.7	88	107
	Jun	5	1330	13.0	100	184	10.1	104	7.9	1.8	75	91
	Jul	10	1135	18.5	3	218	8.7	101	8.1	1.3	84	102
	Aug	4	1500	18.0	2	257	9.8	112				
	Sep	4	1415	14.5	5	268	9.8	104	8.5	0.6	105	128
	Oct	8	1330	6.0	3	283	11.7	102	8.7	0.4	108	132

Table 45. Physical and Chemical Data Obtained By The U.S. Corps of Engineers From Station 3

Kootenai River below Libby Dam, near Libby, Montana
Lat. 48° 22' 00", Long. 115° 19' 20"
River Kilometer 351.2
Elevation 646 Meters MSL

DATE: YEAR	MO	DA	TIME	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00094 CNDUCTVY FIELD MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00400 PH SU	00405 CO2 MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L
1969	Apr	1	1530		21							
		15	1015	6.5	20							
	May	6	1110	8.5	17	234	10.4	96	8.5			
	Jun	3	1535	15.0	52	203	10.2	110	8.0			
		30		14.0	65	201	10.0	105	7.8			
	Aug	3		17.5	2	273	10.9	124	8.6			
	Sep	2		15.2	2	293	10.3	111	8.6			
	Oct	3		9.0	20	266	10.6	99	8.7	0.4	118	144
	Nov	4		5.5	3	306	12.5	107	7.7	5.3	135	165
	Dec	2	1530	0.5	3	336	13.8	204	8.6	0.5	107	130
1970	Jan	2	1250	0.5	2	358	13.6	102	8.7			
	Feb	3	1515	0.5	1	330	12.7	95	8.2	1.5	124	151
	Mar	3	1225	0.5	1	355	13.6	102	8.6	0.6	129	157
	Apr	2	1315	6.5	2	325	12.3	108	8.3	1.1	109	133
	May	5	1430	12.0		200	10.1	102	7.8	2.5	82	100
	Jun	5	1545	13.8	90	172	10.4	109	7.8	2.0	66	80
	Jul	10	1300	18.5	2	215	9.0	104	8.2	1.0	85	104
	Aug	4	1340	17.0	3	258	9.5	107				
	Sep	4	1650	15.0	3	270	10.0	108	8.6	0.5	95	116
	Oct	8	1520	6.0	3	283	11.9	104	8.7	0.4	109	133

Table 46. Physical and Chemical Data Obtained By The U. S. Corps of Engineers from Station 7

Kootenai River at Libby
Lat. 48° 23' 52" Long. 115° 32' 48"
River Kilometer 329.0
Elevation 625 Meters MSL

DATE: YEAR	MO	DA	TIME	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00094 CNDUCTVY FIELD MICROMHO	00300 DO MG/L	00301 DO SATUR PERCENT	00400 PH SU	00405 CO2 MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L
1969	May	6	1025	9.0	17	238	10.6	99	8.5			
	May	14	0730	8.5	120	142						
	Jun	3	1630	15.0	49	185	10.3	110	8.1			
	Jun	30		14.0	48	167	9.8	103	7.8			
	Aug	3		17.8	3	276	10.7	122	8.5			
	Sep	2		14.7	5	283	9.4	100	8.6			
	Oct	3		9.0	21	266	10.9	102	8.8	0.6	122	149
	Nov	4		5.5	4	322	13.3	114	7.9	3.8	130	158
	Dec	2	1420	0.5	14	328	13.9	104	8.4	0.9	106	129
1970	Jan	2	1405	0.5	3	349	13.7	102	8.8			
	Feb	3	1410	0.5	3	340	12.9	96	8.1	2.4	123	150
	Mar	3	1410	0.5	10	340	18.7	102	8.5	0.9	127	155
	Apr	2	1415	6.0	5	325	12.8	111	8.2	1.5	104	127
	May	5	1530	12.0	44	225	10.4	104	7.8	3.0	82	100
	Jun	5	1500	14.9		162	10.2	109	7.8	2.3	63	77
	Jul	10	1400	18.5	3	215	9.0	104	8.3	1.0	80	98
	Aug	4	0940	16.5	5	263	8.7	96				
	Sep	4	1615	15.0	4	263	10.3	110	8.6	0.5	100	122
	Oct	8	1445	6.5	3	280	11.8	103	8.7	0.4	110	134

TABLE 47.1 LOADING CALCULATIONS, KOOTENAI RIVER NEAR REXFORD (STATION 1)

DATE	DISCHG MEAN DLY CFS	RESIDUE DISS-180 T(M)/DAY	CALCIUM CA,DISS T(M)/DAY	MGNSIUM MG,DISS T(M)/DAY	SODIUM Na,DISS T(M)/DAY	HCO3 ION HCO3 T(M)/DAY	SULFATE SO4-TOT T(M)/DAY	CHLORIDE CL T(M)/DAY	SILICA SIO2 T(M)/DAY	FLUORIDE F,DISS KG/DAY
67/06/29	56200*	16915	4676	880	151	14990	2200	55	633	41256
67/07/27	17500*	6295	1584	368	77	4796	1456	77	214	21411
67/09/08	6680*	3580	850	180	46	2158	1161	20	100	21250
67/10/11	4520	2909	741	144	34	1593	1040	24	69	5530
67/11/07	4080	1877	429	120	28	1448	379	19	59	1197
67/12/19	2200	1879	458	81	19	888	743	12	46	11305
68/01/29	2200									
68/03/19	3540	2625	658	113	38	1299	996	21	57	29452
68/04/22	3510	2886	653	120	29	1305	1074	15	54	19755
68/05/22	34800	10644	2725	545	136	8345	2384	102	630	51093
68/06/17	30900	11493	2571	567	106	8771	2193	45	401	45367
68/07/24	16500	5168	1252	319	69	4603	929	65	214	12113
68/08/29	8980	4571	1033	218	55	2681	1362	48	110	19777
68/10/04	7340	2928	736	180	43	2281	665	29	108	19757
68/11/06	5740	2500	548	155	37	1938	449	34	76	12641
68/12/02	4060	1600	378	119	32	1480	378	19	65	8941
69/01/06	3300	1752	371	113	27	1324	347	20	62	7268
69/02/07	2800	1453	308	89	25	1083	308	18	49	6166
69/03/06	2790	1468	314	96	26	1092	307	14	47	8193
69/04/01	4580	2320	538	146	47	1771	527	29	74	22328
69/05/02	18100	6776	1506	407	93	5669	1019	44	257	13287
69/06/09	57300	17106	4347	883	154	17527	1683	140	575	42064
69/07/09	30600	9809	2321	644	120	9285	1498	150	337	22463
69/08/07	11500	4362	985	310	82	3940	732	62	138	0
69/09/04	5890	2638	577	187	61	2277	447	43	72	2883
69/10/16	5030	2326	505	148	46	1883	419	32	71	7385
69/11/05	4130	2072	424	131	42	1577	394	32	73	6064
69/12/01	2970	1541	342	102	32	1235	313	23	49	5814
70/01/05	1300	801	162	51	18	614	146	14	22	2227
70/02/02	2620	1430	308	90	36	1071	308	31	44	4488
70/03/05	2370	1299	284	87	32	974	284	26	45	5799
70/04/08	3590	1915	413	114	39	1432	413	30	51	6149
70/05/08	16300	6023	1276	339	100	4627	877	88	160	19943
70/06/03	31900	9211	2108	554	156	8196	1249	117	258	23418
70/07/07	17000	5408	1248	333	87	4825	790	92	171	8320
70/08/05	7990	3089	704	196	63	2600	489	41	25	7821
70/09/02	4970	2226	474	134	36	1630	365	27	40	10945
70/10/22	4090	1902	440	120	44	1351	420	38	66	8007
70/11/13	3620	1718	372	106	38	1346	372	41	50	8858
70/12/08	3780	1942	416	120	55	1461	398	39	68	8325
71/01/18	2700	1321	330	92	34	1070	311	31	41	6607
71/02/18	3720	1821	401	118	43	1247	346	28	64	10923
71/03/17	2800	1562	329	96	43	1041	315	38	42	10963
71/04/14	4440	1977	478	141	43	1619	424	28	64	13038
71/05/20	26700	7318	203	562	124	7579	1111	14	399	19600
71/06/09	63100	18529	4015	973	170	16521	1853	170	741	30881
71/07/15	26100	7409	1788	473	121	6642	958	172	281	6387
71/08/10	14200	4031	1008	299	122	3926	660	83	125	13899
71/09/07	7310	2683	626	179	55	2272	501	54	86	10733
71/10/14	5280*	2351	517	155	53	1861	478	50	75	11628
71/11/11	4640*	2566	488	148	51	1851	579	49	68	11354
71/12/16	2500*	1456	300	86	32	1132	257	43	42	6118
72/01/10	2500*	1297	288	86	32	985	263	26	43	7341
72/02/07	2500*	1370	288	86	33	967	306	36	44	6729
72/03/14	5100*	2122	549	150	52	1897	449	45	96	14976

*Instantaneous Discharge

TABLE 47.2 LOADING CALCULATIONS, KOOTENAI RIVER NEAR REXFORD (STATION 1)

DATE	PHOS-DIS ORTHO-P KG/DAY	PHOS-DIS P KG/DAY	PHOS-TOT P KG/DAY	NH3-N TOT N KG/DAY	NO3-N N KG/DAY	ORG N N KG/DAY	TOT N N KG/DAY
67/06/29							
67/07/27							
67/09/08							
67/10/11	6304	6968					
67/11/07	697	899					
67/12/19	4953	5060					
68/01/29	5222	5868					
68/03/19	4851	5024					
68/04/22	64[illegible]2	6098					
68/05/22	33211	38320					
68/06/17	10586	17391					
68/07/24	13728	15343					
68/08/29	7471	8130					
68/10/04	2874	3053					
68/11/06	5759	6180					
68/12/02	1888						
69/01/06							
69/02/07	1096	1233					
69/03/06	1775	1843					
69/04/01	112	336					
69/05/02	3986	3986		0	3100	9744	
69/06/09				11217	8413	53281	72911
69/07/09	3744	16473		41932	5241	2995	50168
69/08/07	1407	9568		7879	0	14633	22794
69/09/04	432	1008		4612	0	577	5189
69/10/16	615	985	1846	0	1354	985	2339
69/11/05	606	2324	3335	404	1112	2324	3840
69/12/01	581	945	1017	363	1308	654	2326
70/01/05	445	477	445	859	732	445	2036
70/02/02	256	256	321	641	1603	449	2693
70/03/05	522	696	1044	812	1044	696	2552
70/04/08	791	966	1318	176	1493	1054	2899
70/05/08	2393	2393	15157	1595	7180	11966	22735
70/06/03	3903	5464	32004	3903	9367	12489	27321
70/07/07	2912	3328	4160	1248	2496	4160	7904
70/08/05	1173	1369	1955	782	0	1564	2737
70/09/02	1216	1216	1459	243	365	243	1095
70/10/22	1902		1902	701	2202	1601	4704
70/11/13	3100		3366	797	1860	974	3809
70/12/08	1850		2590	1017	2590	1665	5365
71/01/18	66			0	595	0	595
71/02/18	910		2730	1730	1821	182	3732
71/03/17	1096		1781	2535	685	959	4179
71/04/14	326		1602	2825	1086	1738	5650
71/05/20	5227		13067	3267	6533	14374	24174
71/06/09	9264		46322	37057	16985	1544	55586
71/07/15	639		2555	4471	1916	8941	15328
71/08/10	347		1737	3822	1737	3127	8687
71/09/07	537		1968	1431	1610	1610	4651
71/10/14	129		2326	388	1292	1680	3747
71/11/11	908			4087	1930	0	5223
71/12/16	1040		1346	856	1162	734	2753
72/01/10	918		1346	489	979	1040	2508
72/02/07	734		1162	367	1346	2508	4221
72/03/14	749		1997	1872	2496	2995	7363

TABLE 47.3 LOADING CALCULATIONS, KOOTENAI RIVER NEAR REXFORD (STATION 1)

DATE	ARSENIC AS,DISS KG/DAY	COPPER CU,DISS KG/DAY	LEAD PB,DISS KG/DAY	IRON FE,DISS KG/DAY	MANGNESE MN,DISS KG/DAY	ZINC ZN,DISS KG/DAY
67/06/29						
67/07/27						
67/09/08						
67/10/11						
67/11/07						
67/12/19						
68/01/29						
68/03/19						
68/04/22						
68/05/22						
68/06/17						
68/07/24						
68/08/29						
68/10/04				539		
68/11/06				421		
68/12/02				596		
69/01/06				1938		
69/02/07				206		
69/03/06				410		
69/04/01				448		
69/05/02				3986		
69/06/09				12619		
69/07/09				6739		
69/08/07				844		
69/09/04				577		
69/10/16				246	345	
69/11/05				576	323	
69/12/01				1119	327	
70/01/05				130	121	
70/02/02				571	353	
70/03/05				302	365	
70/04/08				281	378	
70/05/08				2113	798	
70/06/03				0	1561	
70/07/07				3203	874	
70/08/05				1154	215	
70/09/02				1873	280	
70/10/22	100	0	0	2402	180	400
70/11/13	0	0	0	89	151	354
70/12/08	92	0	0	370	324	555
71/01/18	66	7	0	727	0	396
71/02/18	91	18	0	1639	3914	665
71/03/17	69	7	46	959	589	534
71/04/14	0	22	21	326	435	326
71/05/20	0	0	196	7840	0	1307
71/06/09	0	309	772	6176	6176	0
71/07/15	0	64	64	1277	3002	511
71/08/10	0	35	0	695	1042	347
71/09/07	0	18	0	358	179	537
71/10/14	0	0	0	258	129	129
71/11/11	11	0	0	341	341	568
71/12/16	49	37	49	61	184	122
72/01/10	31	0	31	122	122	184
72/02/07	0	6	0	184	483	184
72/03/14	25	0	25	374	724	250

TABLE 48.1 LOADING CALCULATIONS, KOOTENAI RIVER BELOW LIBBY DAM (STATION 3)

DATE	DISCHG MEAN DLY CFS	RESIDUE DISS-180 T(M)/DAY	CALCIUM CA,DISS T(M)/DAY	MGNSIUM MG,DISS T(M)/DAY	SODIUM Na,DISS T(M)/DAY	HCO3 ION HCO3 T(M)/DAY	SULFATE SO4-TOT T(M)/DAY	CHLORIDE CL T(M)/DAY	SILICA S102 T(M)/DAY	FLUORIDE F,DISS KG/DAY
67/06/29	56800	16956	4448	917	195	15011	2363	125	598	69495
67/07/26	18200	7037	1648	387	71	5077	1692	62	232	31175
67/09/07	6930	3663	899	187	47	2306	1153	14	98	22045
67/10/11	4790									
67/11/07	4330									
67/12/15	1950	1612	387	72	18	782	6346	12	35	9543
68/01/24	4100									
68/03/07	4330	3263	752	127	37	1462	1208	24	83	9536
68/04/24	3690									
68/05/27	37200	12015	3004	646	137	10013	2367	164	573	36411
68/06/17	31000									
68/07/23	17500									
68/08/28	8300	4468	995	203	49	2579	1300	37	104	24372
68/10/01	8260									
68/12/05	4430	1854	455	130	33	1604	390	23	68	9756
69/02/04	2900	1476	326	92	24	1121	312	20	53	6387
69/03/04	2700	1394	304	86	23	1057	291	15	48	7268
69/04/03	6110	2736	598	164	49	2078	568	24	124	11961
69/05/07	21200	7730	1764	457	130	6173	986	52	379	15563
69/06/05	61100	16895	4485	942	150	17792	1794	120	419	29902
69/07/08	33500	10903	2951	689	172	10821	1394	131	369	24592
69/08/04	11700	4609	1002	286	74	3951	773	57	137	5726
69/09/02	6560	2793	610	193	53	2456	449	39	83	3210
69/10/15	5550	2417	530	190	49	2037	462	24	71	9506
69/11/04	4340	2124	435	138	48	1572	404	35	72	5310
69/12/02	3000	1527	345	103	30	1248	301	37	49	5139
70/01/12	2300	1272	270	90	33	1024	265	20	41	3377
70/02/04	2700	1381	317	92	36	1090	304	32	44	5286
70/03/04	2400	1304	294	82	32	969	300	30	45	6460
70/04/06	3080	1673	339	106	45	1206	362	26	45	6783
70/05/06	10800	4017	872	230	77	3171	661	58	156	15857
70/06/04	40700	11752	2291	598	189	9362	1295	13	299	19919
70/07/06	18100	6156	1417	390	106	5182	886	102	199	8858
70/08/04	8650	3302	762	205	51	2815	550	40	17	10583
70/09/01	5340	2313	497	144	39	1777	405	21	34	7840
70/10/22	4220	1931	444	124	44	1425	423	48	53	9294
70/11/16	3640	1888	383	107	61	1256	383	39	45	5344
70/12/07	3400	1780	383	108	47	1298	383	43	62	9152
71/01/19	2900	1391	348	99	37	1050	298	106	47	6387
71/02/19	5000	2423	514	147	50	1676	428	38	86	13458
71/03/18	2840	1571	327	90	41	980	306	35	38	10424
71/04/15	5600	2576	548	164	53	1918	466	32	97	15074
71/05/19	27900	8193	1980	539	123	7646	1024	123	444	20481
71/06/10	58000	17315	3690	908	114	15470	1561	142	709	28385
71/07/14	25300	7305	1672	446	93	6315	1548	87	272	12382
71/08/11	14000	4522	1062	298	79	3940	719	123	116	17129
71/09/08	7500	2753	661	184	59	2367	514	50	90	12846
71/10/15	5100	2396	512	162	52	1760	437	50	69	11231
71/11/12	4400	2175	474	140	47	1518	366	56	61	9690
71/12/17	2600	1425	312	89	32	1101	267	31	45	6362
72/01/05	2900	1533	319	99	31	1157	291	32	50	7096
72/02/08	2800	1507	329	103	36	1117	295	41	50	7537
72/03/13	4600	2004	428	124	52	1576	371	52	100	10131
72/03/20	6600	2455	549	153	53	1954	404	39	136	9690
72/03/27	2200	851	188	51	17	694	140	16	48	2692

Table 48.2 LOADING CALCULATIONS, KOOTENAI RIVER BELOW LIBBY DAM (STATION 3)

DATE	PHOS-DIS ORTHO-P KG/DAY	PHOS-DIS P KG/DAY	PHOS-TOT P KG/DAY	NH3-N TOT N KG/DAY	NO3-N N KG/DAY	ORG N N KG/DAY	TOT N N KG/DAY
67/06/29							
67/07/26							
67/09/07	6614	7292					
67/10/11	6212	8439					
67/11/07	848	848					
67/12/15	2338	2768			0		
68/01/24	10835	12039					
68/03/07	7629	7629			529		
68/04/24	6230	6501					
68/05/27	29129	30039					
68/06/17	12896	15930					
68/07/23	5995	6423					
68/08/28	11171	11171			0		
68/10/01	3234	3234					
68/12/05	4661				0		
69/02/04	1419	1490			1277		
69/03/04	1255	1321			462		
69/04/03	150	299			0		
69/05/07	3113	3631			2594		
69/06/05				14951	13456	98678	127085
69/07/08	2459	19674		62301	0	6558	69678
69/08/04	6585	14029		10607	0	10307	20900
69/09/02	321	3692		6421	0	1284	7866
69/10/15	407	1222	2580	407	679	2173	3259
69/11/04	1274	2336	5841	531	637	1062	2230
69/12/02	1175	1835	1982	440	1321	808	2569
70/01/12	394	450	450	619	1576	450	2645
70/02/04	264	264	529	396	1652	529	2577
70/03/04	763	822	1057	529	1409	411	2408
70/04/06	75	754	980	151	980	904	2186
70/05/06	2378	2642	6343	793	4493	8193	16385
70/06/04	3984	3984	42825	7967	23902	17927	50792
70/07/06	4429	5758	5758	886	1772	5315	7972
70/08/04	3175	3810	3810	635	0	847	2117
70/09/01	1045	1176	1307	131	131	784	1045
70/10/22	1652		2169	620	1652	1859	4337
70/11/16	2227		2405	624	2227	1336	4364
70/12/07	3078		2912	1664	2662	915	5408
71/01/19	0			0	639	0	639
71/02/19	1224		2814	122	1224	0	1468
71/03/18	1112		1807	2502	695	486	3683
71/04/15	685		1370	3152	1370	3289	7811
71/05/19	9558		17068	2731	6827	12289	21847
71/06/10	5677		28385	8516	11354	32643	52513
71/07/14	619		3095	4334	0	11144	15477
71/08/11	343		2741	8564	1028	3083	12675
71/09/08	551		2019	1468	551	2936	4955
71/10/15	125		1997	0	1123	1872	2995
71/11/12	861		431	1615	2046	2476	6137
71/12/17	1272		1718	827	1400	763	2990
72/01/05	923		1135	781	1703	1135	3619
72/02/08	822		1233	343	4042	1918	6303
72/03/13	1238		1576	788	5403	2364	8555
72/03/20	162		1777	1131	12759	3876	17765
72/03/27	54		646	431	915	1131	2476

Table 48.3 LOADING CALCULATIONS, KOOTENAI RIVER BELOW LIBBY DAM, (STATION 3)

DATE	ARSENIC AS,DISS KG/DAY	COPPER CU,DISS KG/DAY	LEAD PB,DISS KG/DAY	IRON FE,DISS KG/DAY	MANGNESE MN,DISS KG/DAY	ZINC ZN,DISS KG/DAY
67/06/29						
67/07/26						
67/09/07						
67/10/11						
67/11/07						
67/12/15						
68/01/24						
68/03/07						
68/04/24						
68/05/27						
68/06/17						
68/07/23						
68/08/28						
68/10/01						
68/12/05				1084		
69/02/04				852		
69/03/04				462		
69/04/03				1196		
69/05/07				3113		
69/06/05				5980		
69/07/08				5738		
69/08/04				859		
69/09/02				1284		
69/10/15				217	340	
69/11/04				1221	510	
69/12/02				741	250	
70/01/12				169	79	
70/02/04				218	145	
70/03/04				270	341	
70/04/06				113	211	
70/05/06				3515	766	
70/06/04				0	1096	
70/07/06				2082	753	
70/08/04				1249	233	
70/09/01				483	287	
70/10/22	103	176	0	723	289	310
70/11/16	0	0	0	178	178	267
70/12/07	166	0	0	250	474	333
71/01/19	284	0	0	781	0	426
71/02/19	122	0	61	1958	3059	367
71/03/18	69	7	42	1112	299	195
71/04/15	0	54	0	548	274	411
71/05/19	0	0	68	5462	0	2731
71/06/10	425	142	568	8516	7096	0
71/07/14	0	62	0	1238	3034	433
71/08/11	0	34	69	685	685	0
71/09/08	0	18	0	184	367	551
71/10/15	0	12	25	624	250	250
71/11/12	0	0	0	108	323	431
71/12/17	45	0	6	127		64
72/01/05	7	0	0	71	57	142
72/02/08	62	7	14	137	69	137
72/03/13	90	23	11	450	338	225
72/03/20	16	16	0	323	162	323
72/03/27	32	38	11	108	215	108

TABLE 49.1

LOADING CALCULATIONS, KOOTENAI RIVER AT PORTHILL-COPELAND (STATIONS 9-10)

DATE	DISCHG MEAN DLY CFS	RESIDUE DISS-180 T(M)/DAY	CALCIUM CA,DISS T(M)/DAY	MGNSIUM MG,DISS T(M)/DAY	SODIUM Na,DISS T(M)/DAY	HCO3 ION HCO3 T(M)/DAY	SULFATE SO4-TOT T(M)/DAY	CHLORIDE CL T(M)/DAY	SILICA SIO2 T(M)/DAY	FLUORIDE F,DISS KG/DAY
68/03/13	7950	3074				1538			179	
68/04/03	8990	3146			55	1760	660	44	213	
68/04/17	8970	3929			61	2041	944	22	191	
68/05/08	22100	6597			97	3894	1731	54	416	
68/06/04	67400	15997			231	12040	3793	165	858	
68/07/10	37200	10559			91	8739	2185	182	428	
68/08/06	13100	4007			58	3494	801	64	103	
68/08/20	11400	4073			61	3320	1032	56	153	
68/09/24	10800	4176			58	2696	978	53		
68/11/11	8050	2640			41	1970	492	39	122	
68/12/16	7520	2631			42	1969	1067	18	138	
69/02/12	5020	1646			44	1621	295	25	98	
69/03/18	5340				43	1699	444	26	110	
69/04/22	33500	8443			148	6476	1312	82	820	
69/05/27	81700	18193				16393	2799	200	1499	
69/08/19	9980	3712			66	3224	611	73	112	
69/09/17	6770	3015			53	2303			65	
69/10/20	6130	2475				1890		68		
69/11/18	5250	1966				1580		51		
69/12/16	4370	2010	428	128	44	1593	396	43	84	
70/01/27	4080	1857	379	110	46	1428	529	40	72	
70/02/25	4170	1633				1367		31		
70/03/24	4670	1771				1486		46		
70/04/27	7870	2311	539	156	67	2003	481	67	173	
70/05/18	38100	8484				6340		186		
70/06/16	35100	8589	2061	515	137	7730	1117	129	533	
70/07/14	15300	4942	1161	311	82	4081	674	112	150	11231
70/08/17	6830	2490				1939				
70/09/22	6290	2524				2062	462	54		9235
70/10/20	5050	2088	470	136		1631	408	33		7414
70/11/17	4740	2030				1682				
70/12/15	4100	1565				1284				
71/01/20	6250	2600	596	184		2126	444	4[illegible]	144	9176
71/02/24	6540	1920				1600				
71/03/24	4580	1569	392	123		1367				
71/04/20	13400	2886	820	220		3017	623	46		
71/05/26	58000	14476	2839	653		11212				
71/06/22	47200	16401				10972				
71/07/27	25500	7113	1435	412	94	5990	874	106		12480
71/08/18	10800	3753	819	222	66	3171	502	66		13214
71/09/22	5950	2388	510	160	45	1922	466	38		10192
71/10/19	5560	2286	490	150	49	1823	395	52		12245
71/11/16	5560	2177	476	136	52	1741	395	45		10884
71/12/07	3700	1684	353	100	36	1249	272	33		9959
72/01/10	3380	1563	339	99	33	1232	256	31		3308
72/02/03	2900	1213	270	85	31	986	185	28		5677
72/03/02	13500	2742	595	162	79	2180	429	56		9910

Table 49.2 LOADING CALCULATIONS, KOOTENAI RIVER AT PORTHILL-COPELAND (STATIONS 9-10)

DATE	PHOS-DIS ORTHO-P KG/DAY	PHOS-DIS P KG/DAY	PHOS-TOT P KG/DAY	NH3-N TOT N KG/DAY	NO3-N N KG/DAY	ORG N N KG/DAY	TOT N N KG/DAY
68/03/13	4863		5642		2140		
68/04/03	4879		5855	2200	1980	13199	17511
68/04/17	5487		7243	2195	220	2195	4631
68/05/08	5949		8112	5406	4867	5408	16224
68/06/04	11050		32986	16493	13194	49478	79330
68/07/10	10013		14555	4551	6372	31860	43238
68/08/06	1699		2885	321	160	6091	6732
68/08/20	6137		6137	279	279	2511	3208
68/09/24	5286		6348	132	1321	5286	5946
68/11/11	985		1418	197	984	3743	5122
68/12/16	2944		3128	368	3680	6993	8097
69/02/12	2211		2568	123	2580	8476	11301
69/03/18	1215		1699	131	3267	2483	5815
69/04/22	1803		9017	9837	12296	22953	45906
69/05/27	3998		29988	11995	19992	7997	31987
69/08/19	1172		1343	488	488	9280	10501
69/09/17	596		795	166	663	6461	7306
69/10/20		450	600	150	0	900	1050
69/11/18		899	899	1028	257	1285	2569
69/12/16		0	107	749	749	107	1604
70/01/27		100	299	300	899	399	1697
70/02/25		204	204	0	2347	0	2449
70/03/24		114	300	0	1028	571	1600
70/04/27		193	578	0	385	0	385
70/05/18		2797	7458	1865	8391	5594	16782
70/06/16		5153	7730	1718	7730	6871	16319
72/07/14	2995	2995	4118	1872	749	2246	4867
70/08/17	1003	1003	1003	0	0	1170	1170
70/09/22	1077	1077	1693	0	308	770	1231
70/10/20	1606	1730	1854	741	247	124	1112
70/11/17	1160	1972	2320	348	580	116	1044
70/12/15	1304	1505	1505	301	903	0	1405
71/01/20	0	0		1071	1376	306	3059
71/02/24	1600	1120	1760	1120	3041	320	4641
71/03/24	897	1121	1233	1233	1121		
71/04/20	1312	656	1639	2623	3279	5902	11804
71/05/26	5677	8516	14193	22708	14193	21289	58190
71/06/22	2310	2310	5775	10395	11550	46199	68144
71/07/27	2496	4368	4992	13104	0	180956	193435
71/08/18	529	1321	1586	1859	0	7664	9514
71/09/22	582	1165	16016	1019	0	1747	3058
71/10/19	816	1497	1632	2721	0	136	2857
71/11/16	1088	1769	1905	2585	5986	544	9156
71/12/07	814	1177	1177	181	0	1268	1449
72/01/10	496	744	910	579	1737	1654	3970
72/02/03	923	993	1064	497	2058	1632	4187
72/03/02	661	1652	3964	3964	8589	6607	19160

TABLE 49.3 LOADING CALCULATIONS, KOOTENAI RIVER AT PORTHILL-COPELAND (STATION 9-10)

DATE	ARSENIC AS,DISS KG/DAY	COPPER CU,DISS KG/DAY	LEAD PB,DISS KG/DAY	IRON FE,DISS KG/DAY	MANGNESE MN,DISS KG/DAY	ZINC ZN,DISS KG/DAY
68/03/13						
68/04/03						
68/04/17						
68/05/08						
68/06/04						
68/07/10						
68/08/06						
68/08/20						
68/09/24						
68/11/11						
68/12/16						
69/02/12						
69/03/18						
69/04/22						
69/05/27						
69/08/19						
69/09/17						
69/10/20						
69/11/18	64	385	141	257	257	385
69/12/16						
70/01/27	30	40	230	399	299	100
70/02/25						
70/03/24						
70/04/27	19	96	135	385	385	193
70/05/18	0	373	746	3729	0	932
70/06/16						
70/07/14	75	300	262	374	0	374
70/08/17						
70/09/22						
70/10/20	0					
70/11/17	0	12	0	464	0	0
70/12/15						
71/01/20	0	0	0	3059	0	612
71/02/24						
71/03/24	112	0	22	672	4371	672
71/04/20						
71/05/26	0	284	426	9935	11354	7096
71/06/22						
71/07/27		62	0	624	624	4992
71/08/18		0	0	529		4493
71/09/22		0	44	291		436
71/10/19	0	14	0	136		136
71/11/16		14	27	544		1905
71/12/07		0	0	181		911
72/01/10	0	8	8	165		248
72/02/03		14	99	355		142
72/03/02		66	165	1652		661

Table 50. Number of Insects Collected by Bottom Sampling in the Kootenai River 1968-1971

Location	Total of All Stations			
No. of Samples	38	60	72	60
Year	1968	1969	1970	1971
Plecoptera				
Pteronarcys	3	9	1	1
Pteronarcella	239	443	457	475
Capnia	37	947	35	
Isocapnia		2		
Brachyptera	24	1062		318
Nemoura		26		
Isogenus	285	1597	569	1112
Arcynopteryx	1	3		8
Isoperla	234	104	749	150
Diura			429	
Acroneuria		3	30	11
Classenia	1	4		45
Alloperla	386	21	1038	1338
Unidentified				10
Ephemeroptera				
Baetis	270	3163	3613	1937
Callibaetis		3		
Ameletus	2	82		9
Parameletus		81		
Ephemerella	94	870	246	106
Leptophlebia	19			
Paraleptophlebia		1		
Heptagenia	7	12	187	148
Rhithrogena	12	34	65	756
Cinygmula	3		30	75
Epeorus (Iron)		13		
Unidentified		2		
Trichoptera				
Hydropsyche	1878	2083	6350	4170
Parapsyche	126	378	113	52
Arctopsyche	13			
Cheumatopsyche		4		4072
Brachycentridae	134	155	298	178
Glossosoma	31	82		49
Rhyacophila	1			
Limnephilidae	18	146		
Neothremma	11			
Unidentified		1	41	125
Diptera				
Tendipedidae	3558	8285	10329	7360
Tipula	55	50	54	109
Holorusia	12	24	15	
Hexatoma	48	26	75	108
Simulium	2	19	7	
Tanyderidae				2
Rhagionidae		4	6	
Atherix v.	7	2		14
Empididae	1	2		
Tabanidae				1
Unidentified	18	94		230
Odonata				
Zygoptera		1		
Agrion		1		
Coleoptera				
Elmidae	25	11		19
Hydrophilus		1		
Dytiscidae		7		
Megoloptera				
Sialis	1			
Hemiptera				
Corixidae	64	11		1
TOTAL	7622	19869	24737	22989

Table 51. Number of Insects Collected by Bottom Sampling in the Kootenai River 1968-1971

Location	Rexford (station 1)			
No. of Samples	9	15	18	15
Year	1968	1969	1970	1971
Plecoptera				
Pteronarcys		7		
Pteronarcella	156	157	214	322
Capnia	34	13	6	
Isocapnia				
Brachyptera	3	231		5
Nemoura		10		
Isogenus	115	277	185	431
Arcynopteryx				8
Isoperla	128	5	274	51
Diura			155	
Acroneuria			9	8
Classenia	1	1		23
Alloperla	108	10	200	205
Unidentified				1
Ephemeroptera				
Baetis	92	893	1433	312
Callibaetis				
Ameletus	2	8		
Parameletus		6		
Ephemerella	50	184	82	51
Leptophlebia				
Paraleptophlebia				
Heptagenia		1	62	11
Rhithrogena		9	25	94
Cinygmula			1	17
Epeorus (Iron)				
Unidentified				
Trichoptera				
Hydropsyche	1121	400	1919	2139
Parapsyche	110	69	52	21
Arctopsyche	7			
Cheumatopsyche		4		216
Brachycentridae	48	14	129	67
Glossosoma	12	3		30
Rhyacophila				
Limnephilidae	1	72		
Neothremma				
Unidentified			3	3
Diptera				
Tendipedidae	635	1817	3121	1714
Tipula	31	8	15	25
Holorusia		8		
Hexatoma	7	10	21	19
Simulium		15	7	
Tanyderidae				
Rhagionidae		2	1	
Atherix v.	3			11
Empididae				
Tabanidae				
Unidentified		35		95
Odonata				
Zygoptera		1		
Agrion				
Coleoptera				
Elmidae		2		6
Hydrophilus				
Dytiscidae		4		
Megaloptera				
Sialis				
Hemiptera				
Corixidae		4		
TOTAL	2664	4280	7916	5885

Table 52. Number of Insects Collected by Bottom Sampling in the Kootenai River 1968-1971

Location	Warland (Station 2)			
No. of Samples	10	15	18	15
Year	1968	1969	1970	1971
Plecoptera				
Pteronarcys	3			
Pteronarcella	58	87	195	58
Capnia	3	623	9	
Isocapnia		2		
Brachyptera		465		87
Nemoura				
Isogenus	90	164	235	289
Arcynopteryx				
Isoperla	46	58	211	11
Diura			122	
Acroneuria		2	19	3
Claassenia		1		12
Alloperla	67		456	452
Unidentified				
Ephemeroptera				
Baetis	17	778	1047	991
Callibaetis				
Ameletus		47		
Parameletus		60		
Ephemerella	1	258	98	18
Leptophlebia				
Paraleptophlebia				
Heptagenia		3	52	129
Rhithrogena		6	26	317
Cinygmula	3		18	58
Epeorus (Iron)		6		
Unidentified				
Trichoptera				
Hydropsyche	261	540	2572	696
Parapsyche	6	206	43	6
Arctopsyche	5			
Cheumatopsyche				2437
Brachycentridae	27	87	92	51
Glossosoma	1	8		4
Rhyacophila	1			
Limnephilidae	4	39		
Neothremma				
Unidentified				110
Diptera				
Tendipedidae	1345	3036	2801	2131
Tipula	14	14	18	51
Holorusia		4	7	
Hexatoma	32	9	17	57
Simulium	2			
Tanyderidae				
Rhagionidae		1	1	
Atherix v.				1
Empididae				
Tabanidae				
Unidentified	1	38		57
Odonata				
Zygoptera				
Agrion				
Coleoptera				
Elmidae	2	5		13
Hydrophilus				
Dytiscidae		2		
Megaloptera				
Sialis	1			
Hemiptera				
Corixidae	64	7		
TOTAL	2054	6556	8039	8039

Table 53. Number of Insects Collected by Bottom Sampling in the Kootenai River 1968-1971

Location	Below Dam	(Station 3)		
No. of Samples	9	15	18	15
Year	1968	1969	1970	1971
Plecoptera				
Pteronarcys		2	1	
Pteronarcella	21	170	4	16
Capnia		207		
Isocapnia				
Brachyptera	7	259		118
Nemoura		16		
Isogenus	62	716	52	208
Arcynopteryx	1	3		
Isoperla	8	24	177	86
Diura	2		95	
Acroneuria				
Claassenia		2		3
Alloperla	158	8	264	412
Unidentified				
Ephemeroptera				
Baetis	106	1247	749	278
Callibaetis				
Ameletus		14		2
Parameletus		15		
Ephemerella	42	320	40	8
Leptophlebia	19			
Paraleptophlebia		1		
Heptagenia	7	3	28	7
Rhithrogena	12	12	5	114
Cinygmula			10	
Epeorus (Iron)		7		
Unidentified				
Trichoptera				
Hydropsyche	317	972	958	416
Parapsyche	4	87	8	14
Arctopsyche	1			
Cheumatopsyche				843
Brachycentridae	52	51	43	43
Glossosoma	18	68		12
Rhyacophila				
Limnephilidae	11	32		
Neothremma	8			
Unidentified			22	
Diptera				
Tendipedidae	246	1602	1963	1878
Tipula	6	17	10	16
Holorusia	7	4	8	
Hexatoma	9	3	25	16
Simulium		1		
Tanyderidae				1
Rhagionidae		1	2	
Atherix v.	3	2		1
Empididae	1	2		
Tabanidae				
Unidentified	17	16		26
Odonata				
Zygoptera				
Agrion		1		
Coleoptera				
Elmidae	9	4		
Hydrophilus		1		
Dytiscidae				
Megaloptera				
Sialis				
Hemiptera				
Corixidae				1
TOTAL	1154	5890	4466	4519

Table 54. Number of Insects Collected by Bottom Sampling in the Kootenai River
1968-1971

Location	Lowry Gulch (Station 4)			
No. of Samples	10	15	18	15
Year	1968	1969	1970	1971
Plecoptera				
Pteronarcys				1
Pteronarcella	4	29	44	79
Capnia		104	20	
Isocapnia				
Brachyptera	14	107		108
Nemoura				
Isogenus	18	440	97	184
Arcynopteryx				
Isoperla	52	17	87	2
Diura			57	
Acroneuria		1		
Claassenia				7
Alloperla	53	3	118	269
Unidentified				9
Ephemeroptera				
Baetis	55	245	384	356
Callibaetis		3		
Ameletus		13		7
Parameletus				
Ephemerella	1	108	26	29
Leptophlebia				
Paraleptophlebia				
Heptagenia		5	45	1
Rhithrogena		7	7	231
Cinygmula			1	
Epeorus (Iron)				
Unidentified		2		
Trichoptera				
Hydropsyche	179	171	901	919
Parapsyche	6	16	10	11
Arctopsyche				
Cheumatopsyche				576
Brachycentridae	7	3	34	17
Glossosoma		3		3
Rhyacophila				
Limnephilidae	2	3		
Neothremma	3			
Unidentified		1	16	12
Diptera				
Tendipedidae	1332	1830	2444	1637
Tipula	4	11	11	17
Holorusia	5	8		
Hexatoma		4	12	16
Simulium		3		
Tanyderidae				1
Rhagionidae			2	
Atherix v.	1			1
Empididae				
Tabanidae				1
Unidentified		5		52
Odonata				
Zygoptera				
Agrion				
Coleoptera				
Elmidae	14			
Hydrophilus				
Dytiscidae		1		
Megaloptera				
Sialis				
Hemiptera				
Corixidae				
TOTAL	1750	3143	4316	4546

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Table 55. Number and Weight of Insects Collected by Bottom Sampling in the Kootenai River 1968-1971.

	Total of all stations			
No. of Samples	38	60	72	60
Year	1968	1969	1970	1971
Plecoptera				
Number	1212	4221	3308	3468
Weight	20.25	26.81	80.91	76.99
Ephemeroptera				
Number	407	4261	4141	3031
Weight	1.58	14.44	14.40	16.41
Trichoptera				
Number	2212	2849	6802	8646
Weight	31.15	29.02	102.07	187.35
Diptera				
Number	3701	8506	10486	7824
Weight	14.05	20.46	29.73	46.21
Odonata				
Number		2		
Weight		0.12		
Coleoptera				
Number	25	19		19
Weight	0.02	0.08		tr
Megaloptera				
Number	1			
Weight	tr			
Hemiptera				
Number	64	11		1
Weight	1.22	tr		tr
TOTAL				
Number	7622	19869	24737	22989
Weight	68.27	90.93	227.11	326.96

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Table 56. Number and Weight of Insects Collected by Bottom Sampling in the Kootenai River 1968-1971.

Location:	Rexford (Station 1)			
No. of Samples	9	15	18	15
Year	1968	1969	1970	1971
Plecoptera				
Number	545	711	1043	1054
Weight	10.75	6.60	31.59	32.52
Ephemeroptera				
Number	144	1101	1605	485
Weight	0.40	2.89	4.63	3.70
Trichoptera				
Number	1299	562	2103	2476
Weight	14.83	6.77	32.38	59.10
Diptera				
Number	676	1895	3165	1864
Weight	1.64	5.27	8.07	9.93
Odonata				
Number		1		
Weight		0.12		
Coleoptera				
Number		6		6
Weight		0.04		tr
Megaloptera				
Number				
Weight				
Hemiptera				
Number		4		
Weight		tr		
TOTAL				
Number	2664	4280	7916	5885
Weight	27.62	21.69	76.67	105.25

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Table 57. Number and Weight of Insects Collected by Bottom Sampling in the Kootenai River 1968-1971.

Location:	Warland (Station 2)			
No. of Samples	10	15	18	15
Year	1968	1969	1970	1971
Plecoptera				
Number	267	1042	1247	912
Weight	6.18	6.86	32.03	16.85
Ephemeroptera				
Number	21	1158	1241	1513
Weight	0.30	4.93	4.22	6.85
Trichoptera				
Number	305	880	2707	3304
Weight	7.24	8.95	40.00	72.00
Diptera				
Number	1394	3102	2844	2297
Weight	8.28	5.57	8.00	17.90
Odonata				
Number				
Weight				
Coleoptera				
Number	2	7		13
Weight	tr	0.03		tr
Megaloptera				
Number	1			
Weight	tr			
Hemiptera				
Number	64	7		
Weight	1.22	tr		
TOTAL				
Number	2054	6556	8039	8039
Weight	23.22	26.34	84.25	113.60

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Table 58 Number and Weight of Insects Collected by Bottom Sampling in the Kootenai River 1968-1971.

Location:	Below Dam (Station 3)			
No. of Samples	9	15	18	15
Year	1968	1969	1970	1971
Plecoptera				
Number	259	1407	595	843
Weight	1.98	9.36	6.63	14.30
Ephemeroptera				
Number	186	1619	832	409
Weight	0.70	5.64	2.68	2.25
Trichoptera				
Number	411	1210	1031	1328
Weight	7.52	10.16	15.90	27.15
Diptera				
Number	289	1648	2008	1938
Weight	1.60	5.30	6.51	8.83
Odonata				
Number		1		
Weight		tr		
Coleoptera				
Number	9	5		
Weight	0.01	0.01		
Megaloptera				
Number				
Weight				
Hemiptera				
Number				1
Weight				tr
TOTAL				
Number	1154	5890	4466	4319
Weight	11.81	30.47	31.72	52.53

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Table 59 Number and Weight of Insects Collected by Bottom Sampling in the Kootenai River 1968-1971.

Location:	Lowry Gulch (Station 4)			
No. of Samples	10	15	18	15
Year	1968	1969	1970	1971
Plecoptera				
Number	141	701	423	659
Weight	1.34	3.99	10.66	13.32
Ephemeroptera				
Number	56	383	463	624
Weight	0.18	0.98	2.87	3.61
Trichoptera				
Number	197	197	961	1538
Weight	1.56	3.14	13.79	29.10
Diptera				
Number	1342	1861	2469	1725
Weight	2.53	4.32	7.15	9.55
Odonata				
Number				
Weight				
Coleoptera				
Number	14	1		
Weight	0.01	tr		
Megaloptera				
Number				
Weight				
Hemiptera				
Number				
Weight				
TOTAL				
Number	1750	3143	4316	4546
Weight	5.62	12.43	34.47	55.58

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Table 60 Number and Weight of Insects Per Square Meter Collected by Bottom Sampling in the Kootenai River, 1968-1971.

Location	Total of all stations			
Year	1968	1969	1970	1971
Plecoptera				
no/m^2	343	757	495	622
gm/m^2	5.7	4.8	12.1	13.8
Ephemeroptera				
no/m^2	115	764	619	544
gm/m^2	0.4	2.6	2.2	2.9
Trichoptera				
no/m^2	627	511	1017	1551
gm/m^2	8.8	5.2	15.3	33.6
Diptera				
no/m^2	1048	1526	1568	1404
gm/m^2	4.0	3.7	4.4	8.3
Odonata				
no/m^2				
gm/m^2				
Coleoptera				
no/m^2	7	tr		3
gm/m^2	tr	tr		tr
Megaloptera				
no/m^2	1	3		
gm/m^2	tr	tr		
Hemiptera				
no/m^2	18	2		tr
gm/m^2	0.3	tr		tr
Total				
no/m^2	2159	3565	3698	4124
gm/m^2	19.3	16.3	34.0	58.7

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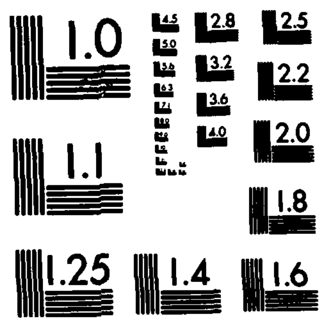

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Table 61 Number and Weight of Insects Per Square Meter Collected by Bottom Sampling in the Kootenai River, 1968-1971.

Location	Rexford (Station 1)			
Year	1968	1969	1970	1971
Plecoptera				
no/m 2	652	510	624	756
gm/m 2	13.0	4.7	18.9	23.3
Ephemeroptera				
no/m 2	172	790	960	348
gm/m 2	0.5	2.1	1.7	2.7
Trichoptera				
no/m 2	1554	403	1258	1777
gm/m 2	17.7	4.9	19.4	42.4
Diptera				
no/m 2	809	1360	1893	1338
gm/m 2	2.0	3.8	4.8	7.1
Odonata				
no/m 2		1		
gm/m 2		0.1		
Coleoptera				
no/m 2		4		4
gm/m 2		tr		tr
Megaloptera				
no/m 2				
gm/m 2				
Hemiptera				
no/m 2		3		
gm/m 2		tr		
Total				
no/m 2	3225	3071	4734	4223
gm/m 2	33.0	15.6	45.8	75.5

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Table 62 Number and Weight of Insects Per Square Meter Collected by Bottom Sampling in the Kootenai River, 1968-1971.

Location	Warland (Station 2)			
Year	1968	1969	1970	1971
Plecoptera				
no/m 2	287	1006	746	654
gm/m 2	6.7	4.9	19.2	12.1
Ephemeroptera				
no/m 2	22	831	742	1086
gm/m 2	0.3	3.5	2.5	4.9
Trichoptera				
no/m 2	328	632	1619	2371
gm/m 2	7.8	6.4	23.9	51.7
Diptera				
no/m 2	1501	2226	1701	1648
gm/m 2	8.9	4.0	4.7	12.8
Odonata				
no/m 2				
gm/m 2				
Coleoptera				
no/m 2	2	5		9
gm/m 2	tr	tr		tr
Megaloptera				
no/m 2	1			
gm/m 2	tr			
Hemiptera				
no/m 2	69	5		
gm/m 2	1.3	tr		
Total				
no/m 2	2211	4704	4807	5769
gm/m 2	25.0	18.9	30.4	81.5

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Table 63 Number and Weight of Insects Per Square Meter Collected by Bottom Sampling in the Kootenai River, 1968-1971.

Location	Below Dam (Station 3			
Year	1968	1969	1970	1971
Plecoptera				
no/m^2	310	1009	356	605
gm/m^2	2.3	6.7	3.8	10.3
Ephemeroptera				
no/m^2	201	1162	498	294
gm/m^2	0.8	4.0	1.6	1.6
Trichoptera				
no/m^2	492	868	616	953
gm/m^2	9.0	7.3	9.5	19.5
Diptera				
no/m^2	346	1183	1201	1391
gm/m^2	1.9	3.8	3.9	6.3
Odonata				
no/m^2		1		
gm/m^2		tr		
Coleoptera				
no/m^2	11	4		
gm/m^2	tr	tr		
Megaloptera				
no/m^2				
gm/m^2				
Hemiptera				
no/m^2				1
gm/m^2				tr
Total				
no/m^2	1380	4227	2671	3243
gm/m^2	14.1	21.9	19.0	37.7

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Table 64 Number and Weight of Insects Per Square Meter Collected by Bottom Sampling in the Kootenai River, 1968-1971.

Location	Lowry Gulch (Station 4)			
Year	1968	1969	1970	1971
Plecoptera				
no/m^2	152	503	253	473
gm/m^2	1.4	2.9	6.4	9.6
Ephemeroptera				
no/m^2	60	275	277	448
gm/m^2	0.2	0.7	1.7	2.6
Trichoptera				
no/m^2	212	141	575	1104
gm/m^2	1.7	2.3	8.2	20.9
Diptera				
no/m^2	1445	1335	1476	1238
gm/m^2	2.7	3.1	4.3	6.9
Odonata				
no/m^2				
gm/m^2				
Coleoptera				
no/m^2	15	1		
gm/m^2	tr	tr		
Megaloptera				
no/m^2				
gm/m^2				
Hemiptera				
no/m^2				
gm/m^2				
Total				
no/m^2	1884	2255	2581	3262
gm/m^2	6.0	8.9	20.6	39.9

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Table: 65 Number of Insects Collected by Cylindrical Substrate Sampler in the Kootenai River in 1968 and 1969.

Location	Rexford		Warland		Below Dam		Total	
No. of Samples	9	9	5	9	9	9	23	27
Year	1968	1969	1968	1969	1968	1969	1968	1969
Plecoptera								
Pteronarcella	132	256	28	372	129	158	289	786
Capniinae	9		3				12	
Capnia	4	11		11	7	12	11	34
Brachyptera	45	13	23	228	24	68	92	309
Nemoura						3		3
Isogenus	124	225	26	519	109	469	259	1213
Arcynopteryx		29			1		1	29
Isoperla	2	4	6	28	22	13	30	45
Acroneuria		3						3
Claassenia	1						1	
Alloperla	30	2	30	8	57	394	117	404
Ephemeroptera								
Baetis	38	410	104	643	133	1151	275	2204
Ameletus		1		6		18		25
Ephemerella	5	112	73	471	29	490	107	1073
Leptophlebia	1	6			1		2	6
Rhithrogena		6		3		2		11
Cinygmula				7		3		10
Trichoptera								
Hydropsyche	388	576	75	1401	5016	4767	5479	6744
Parapsyche	65	137	23	351	225	1338	313	1826
Cheumatopsyche	18			11	20	11	38	22
Brachycentrus	68	35	7	108	411	134	486	277
Glossosoma		27		58		17		102
Rhyacophila				19				19
Limnephilidae		87		30		123		240
Neothremma					25		25	
Diptera								
Tendipedidae	268	454	190	1073	455	974	913	2501
Tipula			3	27	19	2	22	29
Holorusia		3	7		5	17	12	20
Hexatoma			2	5	31	5	33	10
Simulium	19	50	14	37	63	266	96	353
Atherix v.						1		1
Unidentified		4		4		2		10
Odonata								
Agrion						2		2
Coleoptera								
Elmidae		1		1		2		4
Hydrophilae				1		1		2
Dytiscidae						3		3
Megaloptera								
Sialis		1						1
TOTAL	1217	2453	614	5422	6782	10446	8613	18321

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Table 66 Total Number and Weight of Insects Collected by Cylindrical Substrate Sampler in the Kootenai River in 1968 and 1969.

Location:	Rexford		Warland		Below Dam		Total	
No. of Samples	9	9	5	9	9	9	23	27
Year	1968	1969	1968	1969	1968	1969	1968	1969
Plecoptera								
Number	347	543	116	1166	349	1117	812	2826
Weight	8.73	3.32	2.66	7.74	7.97	6.33	19.36	17.39
Ephemeroptera								
Number	44	535	177	1130	163	1664	384	3329
Weight	0.07	1.75	0.22	0.86	0.82	3.16	1.11	5.77
Trichoptera								
Number	539	862	105	1978	5697	6390	6341	9230
Weight	14.51	7.89	2.49	13.16	100.63	31.69	117.69	52.74
Diptera								
Number	287	511	216	1146	573	1267	1076	2924
Weight	0.42	1.91	0.93	3.29	4.48	2.97	5.83	8.17
Odonata								
Number						2		2
Weight						0.03		0.03
Coleoptera								
Number		1		2		6		9
Weight		tr		tr		0.14		0.14
Megaloptera								
Number		1						1
Weight		tr						tr
Hemiptera								
Number								
Weight								
Total								
Number	1217	2453	614	5422	6782	10446	8613	18321
Weight	23.73	14.87	6.30	25.05	113.90	44.32	143.99	84.24

Table 67 Average Number and Weight of Insects Collected by Cylindrical Substrate in the Kootenai River in 1968 and 1969.

Location:	Rexford		Warland		Below Dam		Total	
No. of Samples	9	9	5	9	9	9	23	27
Year	1968	1969	1968	1969	1968	1969	1968	1969
Plecoptera								
Number/sample	39	60	23	130	39	124	35	105
Weight/sample	1.0	0.4	0.5	0.9	0.9	0.7	0.8	0.6
Ephemeroptera								
Number/sample	5	59	35	126	18	185	17	123
Weight/sample	tr	0.2	tr	0.1	0.1	0.4	tr	0.2
Trichoptera								
Number/sample	60	96	21	220	633	710	276	342
Weight/sample	1.6	0.9	0.6	1.5	11.2	3.5	5.1	2.0
Diptera								
Number/sample	32	57	43	127	64	141	47	108
Weight/sample	tr	0.2	0.2	0.4	0.5	0.3	0.3	0.3
Odonata								
Number/sample						tr		tr
Weight/sample						tr		tr
Coleoptera								
Number/sample		tr		tr		1		tr
Weight/sample		tr		tr		tr		tr
Megaloptera								
Number/sample		tr						tr
Weight/Sample		tr						tr
Hemiptera								
Number/sample								
Weight/sample								
Total								
Number/sample	135	273	123	602	754	1161	374	679
Weight/sample	2.6	1.7	1.3	2.8	12.7	4.9	6.3	3.1

Note: Totals may not add due to rounding.

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